5

THE JOURNAL OF ENGINEERING EDUCATION

Published by the Society for the Promotion of Engineering Education

Published monthly, except July and August, under the supervision of the Publication Committee. A. A. Potter, P. F. Walker, F. L. Bishop, Editor, University of Pittsburgh. Published at Prince and Lemon Sts., Lancaster, Pa.

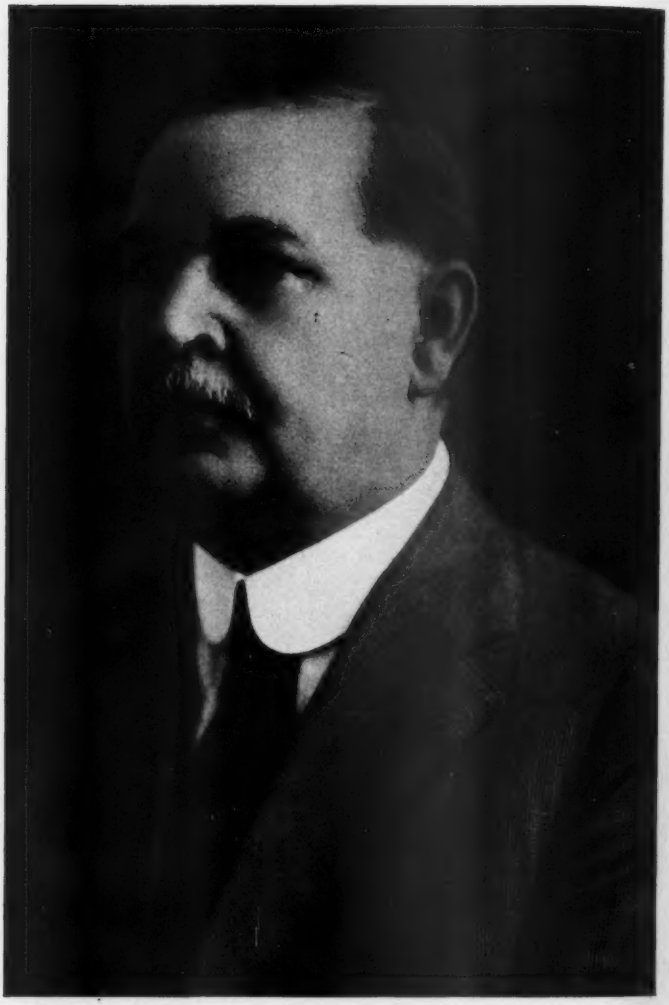
Entered as second-class matter at the Post Office at Lancaster, Pa., under the Act of August 12, 1912.

New Series Vol. XV, No. 5. JANUARY, 1925. Subscription Price, $3.00 per year. Single Copies, 50 cents

TABLE OF CONTENTS.

Why Investigate Engineering Education? A. A. Potter, President of the Society 311
Objectives and Outline of Procedure 315
Report of the Director of Investigations 324
Report of the Associate Director of Investigations 330
Selling English at Iowa State College 334
The New Coöperative Options in the Engineering Courses at New York University, J. W. Roe 342
The Lamme Award 348
Benjamin Garver Lamme 350
New Members 358
Acknowledgment 359
Minutes of the Meeting of Division of Deans and Administrative Officers, January, 1924 360
Sections and Branches
Kansas-Nebraska Section 401
Minnesota Section 403
North Carolina Section 404
Purdue Branch 407
Book Review i
Books Received i

311-1



BENJAMIN GARVER LAMME

WHY INVESTIGATE ENGINEERING EDUCATION?*

BY

A. A. POTTER,

Dean of Engineering, Purdue University and
President of the Society.

Much publicity has been given to the investigation of engineering education which is now being carried on by the S. P. E. E. under a grant of funds made available by the Carnegie Foundation. The question comes up why investigate engineering education?

One who analyzes the product of our engineering colleges is soon convinced that American engineering education has been a success. Those who are responsible for the present curricula of our engineering colleges did well in developing a type of education which has been an important factor in the upbuilding of our industries and utilities while commanding the respect of the public on account of its mathematical and exact character. Contrary to the statements sometimes made by those who know nothing about Engineering Education the engineering curricula have continuously been adapted to the changing needs of the times. Our courses as at present constituted are not highly specialized but our students devote about one half of their time to general collegiate subjects, about one fourth to general engineering topics and not over one fourth to specialized engineering courses.

The study which is now being conducted by the engineering colleges in coöperation with the S. P. E. E. indicates that no revolutionary change of engineering education will be necessary. Neither will the standardization of engineering courses be advocated as the diversity of engineering activities, the local problems of different institutions, and the differences in the capacities of students call for consideration of more elastic rather than for standardized educational processes.

* Paper presented before the Purdue Branch of the S. P. E. E., Dec. 11, 1924.

WHY INVESTIGATE ENGINEERING EDUCATION?

While the accomplishments of the engineering colleges during the past fifty years have been most creditable, we must realize that engineering is assuming a constantly greater place in modern life. The question is what can be done in order that our engineering graduates of the future may be men of broad vision with the ability to solve the technical problems of their profession but who can also direct for the benefit of humanity the new forces which science and engineering have created? In short we must look ahead twenty-five years, fifty years or even farther and consider what changes must be made in our curricula and methods of teaching in order that our graduates may be in a position to contribute the most to the common good?

In connection with the question of broader service for the engineer the following matters must be considered by engineering educators:

1. What are the functions of engineering colleges? Are we to give a collegiate education based upon the scientific and technological foundations of industry or are we to provide a professional training in engineering comparable with that in medicine or law? This determination of the fundamental purposes and functions of the engineering colleges in the fields of education, industry and professional service is the most important problem which is now confronting engineering educators. The surveys which are now in progress of the needs of industry, the requirements of practice, the preparation and characteristics of students and the fields of activity for engineering graduates are designed to furnish evidence bearing upon this important problem.

2. Do the requirements for admission to our engineering colleges fit into the curricula as at present administered so that entering students take up their work without disastrous breaks or gaps and yet without serious overlapping? If not what can be done about this matter? Would more effective coöperation on the part of colleges with secondary schools help or should the engineering curricula be readjusted to better fit the preparation of the student?

It is the purpose to consider how the entrance requirements to our engineering colleges and the courses of study in secondary schools may be mutually adjusted.

3. Do our engineering colleges attract under present conditions the most desirable of the graduates of secondary schools? If not how can we insure that properly qualified students will be so attracted? It is the purpose to consider what information concerning an engineering career should be provided and what guidance given, both before and after admission to the engineering college, in the choice of educational programs.

4. Do our curricula, as at present laid out and administered, tend to produce the maximum mental growth and development of each student? If not how can this situation be improved? It is hoped that criteria may be formulated for the selection of the content of the scientific, engineering, economic and cultural subjects of instruction, and for the correct articulation and proportioning of major subjects of the curricula.

5. Would it be desirable to make our engineering courses more flexible in order that the extent of training may be adjusted to the capacities of our students and to the requirements and opportunities of industry as well? If so how can this be accomplished?

6. Are the engineering curricula effectively coördinated with the needs of industry and the requirements of engineering practice? It is expected to determine how adjustment may be effected between the need for specific training on the one hand and broad training on the other so that there will be reasonable demands for the services of engineering graduates immediately after graduation from college, but without sacrificing their foundation for advancement to broader responsibilities in their profession, in industry and in public life.

7. Should the colleges assume any responsibility for the further training of their graduates? If so how can the responsibility for such training be shared by the colleges and

the industries? It is expected to ascertain the need among engineering graduates for more extended training and to point out how these needs may be filled through resident and non-resident instruction.

8. Is the present system of recruiting and training of engineering teaching staffs such that the quality of instruction is being constantly improved? If not what steps must be taken to improve methods of teaching in engineering colleges?

9. Are the engineering colleges training too many or not enough engineers? It is the purpose to find out the economic demand for engineering graduates; to ascertain what types of positions and fields of work the graduates are qualified to fill; and to consider how the employment of graduates can be facilitated.

10. How does American engineering education compare with that of other countries? An analytical comparison is now being made by the Director of Investigations of the organization and practices of engineering education in Europe and in America.

11. Is a closer association between the engineering colleges, industries, utilities and the professional organizations of engineering desirable? It is expected that constructive suggestions will be available so that this can be brought about for the mutual benefit of all?

12. Is there sufficient appreciation on the part of the public of the importance of engineering in modern life? If not how can this be remedied? Will the broadening of our engineering curricula help? If so, should certain technical phases of the present work be omitted or should the length of the engineering course be increased to five or six years?

Ninety-nine engineering colleges, engineering societies, industries, utilities, Government Departments and others, are coöperating with the Director of Investigation of the S. P. E. E. in securing answers to the above and to many other questions. Much valuable information has already been secured and with the coöperation of all friends of engineering education this study will be of great and lasting value.

STATEMENT OF OBJECTIVES AND OUTLINE OF PROCEDURES OF THE INVESTIGATION OF ENGINEERING EDUCATION

The general investigation of engineering education in which the Society is now engaged was prompted by the question "What can the Society do in a comprehensive way to develop, broaden and enrich engineering education?" and is the first stage of the process of translating the aspirations implied by this question into a program of definite accomplishment.

The investigation has now passed through its preliminary reconnaissance and organization stages. During this period attention has been devoted chiefly to the organization of a central staff and the coöperative agencies through which the undertaking will be carried out; and to a comprehensive preliminary survey and the collection and study of the opinions of college executives, teachers, industrial leaders, and others as to the ends sought in the investigation and the means to be used to attain those ends.

With the completion of this preliminary stage, the objectives of the investigation have been formulated and are herein set forth. This statement is necessarily provisional to a certain extent, since the investigation as a whole is diagnostic in nature and should lead to conclusions rather than follow them. It is published in order that all concerned in the undertaking shall share in the conception of purposes which is in the minds of those who are supervising and coördinating the work.

General Conception of the Investigation.

The central problem of the investigation is believed to be the determination of the fundamental purposes and functions of the engineering colleges in the fields of education, industry, professional life and public service.

A clear conception of these functions is essential if the colleges are to solve many of the specific problems which confront them. The investigation is therefore being focused upon this central problem and its numerous divisions are planned with this as a guiding principle. It is proposed that the three-year period of the Carnegie grant shall be devoted primarily to the investigative stage of the undertaking. It is expected that this will be followed by, and to a considerable extent be concurrent with, a coördinated effort on the part of the colleges to adjust their curricula and educational methods so as to serve their proper functions most effectively.

The preliminary reconnaissance seems clearly to indicate that the future course of the engineering colleges will be an orderly and intelligent readjustment of their educational programs, rather than a revolutionary change. The investigation is being shaped to this end. Furthermore, it appears that the breadth and diversity of engineering activities are such as to make undesirable the standardization of engineering courses or their reduction to a uniform plan.

Since the present stage of the project is primarily investigative in character, the policy has been adopted of first gathering the facts bearing upon the situation. A group of cooperative agencies including the Faculty Committees, the United States Bureau of Education, engineering societies and other bodies, are now engaged in gathering the facts. In order that the work of these agencies may be properly coördinated and directed toward common objectives, there has been a considerable measure of central planning through the Director's Office.

The National Industrial Conference Board is conducting studies of the occupational demand and opportunity for graduates in industry as a coördinate undertaking. These studies have been in progress for some time and have reached a well advanced stage.

As a supplement to their contribution to the general program, many of the Faculty Committees are studying the distinctive problems pertaining to their own institutions. It

is the policy to encourage studies of this character and to provide some measure of general coördination for them. It is clear, however, that the initiative in such work must come from the committees themselves.

It is planned to interpret the evidence gathered in the Society's Investigation in collaboration with special committees of the Society and to present the results of the investigation in the form of a report or reports.

In the memorandum sent to the Carnegie Corporation preliminary to the grant of funds it was proposed that the investigation be *"directed to a study of the objects of engineering education and the fitness of the present-day curricula."* These general purposes have been developed into the following specific objectives.

Objectives of the Investigation.

I. *It is the intention to clarify the educational functions and responsibilities of the colleges of engineering:*

a. To define the educational functions of the colleges of engineering.

It is the purpose to determine to what extent the program of engineering education serves a *collegiate* type of training employing science and technology as its principal media; and to what extent it provides a *professional* type of training comparable with that in medicine.* It is the purpose to ascertain whether further differentiation between these two functions and further development in each is desirable and to define the boundaries within which the educational jurisdiction of the engineering colleges should lie.

The surveys which are now in progress of the needs of industry, the requirements of practice, the preparation and characteristics of students and the

*See "College Education and Professional Training" by W. E. Wickenden in Journal of Engineering Education for November, 1924.

fields of activity of graduates are designed to contribute evidence bearing upon this problem and upon others which follow.

b. To indicate how engineering curricula may be coordinated more effectively with the needs of industry and the requirements of engineering practice.

It is the desire to determine how adjustment between the need for specific training on the one hand and for broad training on the other may be effected so as to provide to a reasonable degree for the immediate demands upon graduates in their earlier positions, and at the same time to provide the foundation for advancement to broader duties in the industrial and professional world and in public life.

c. To determine whether or not it may be desirable and practicable to vary the extent of training in engineering to accord with

(*a*) the capacities of students, and

(*b*) the requirements and opportunities of industry.

Consideration will be given to a more elastic educational program than is now in effect, in order to determine whether or not both the duration and content of engineering courses may be varied to suit differences in the capacities of students and to fit more closely the requirements of industry for technically trained men.

d. To determine what responsibilities the colleges should assume for the further training of graduates.

It is the purpose to ascertain the need among graduates for more extended training in special fields than that provided by their undergraduate courses; to point out how these needs may be filled through resident and non-resident instruction; and to determine how the responsibility for such train-

ing may best be shared by the colleges and the industries.

II. *It is the intention to establish guiding principles for the the content and arrangement of curricula and the improvement of teaching:*

a. To formulate criteria for selection of the content of of the scientific, technological, economic and "cultural" subjects of instruction, and for the proportioning of these major divisions of curricula.

b. To promote more effective articulation of instruction in the various subjects which make up an engineering curriculum.

There is much evidence of the need of more effective coöperation in teaching groups of closely related subjects such as mathematics, physics, and mechanics, and the necessity for more direct and valid articulation of instruction in mathematics, economics and the physical sciences with that in technological subjects.

c. To indicate means of more valid correlation of instruction in engineering with the technical and economic problems of engineering practice and to indicate how such problems may be used as means of teaching fundamental principles inductively.

d. To ascertain directions which may be taken to improve methods of teaching in engineering colleges and to encourage study and experimentation in those directions.

III. *It is the intention to consider in what ways problems relating to engineering students, graduates and teachers may be dealt with more effectively:*

a. To determine what steps may be taken to insure the entrance of properly qualified students.

It is the purpose to consider how the entrance re-

quirements of engineering colleges and the programs of secondary schools may be mutually adjusted; to consider what selective processes of a non-scholastic type may be used as a valid supplement to scholastic requirements for admission; and to consider what information concerning an engineering career should be provided and what guidance given, both before and after admission, in the choice of educational programs.

b. To determine what measures may be taken to deal more effectively with the problem of eliminations.

It is the purpose to learn at what periods and for what reasons students are eliminated or withdraw from college, to ascertain the fundamental causes of failures; and to determine how cases of impending failure may best be dealt with.

c. To ascertain the methods which may best be used by the colleges to facilitate the obtaining of suitable employment by their graduates and to promote their further development.

It is the purpose to canvass the economic demand for engineering graduates through the coöperation of the industries and professional organizations; to ascertain the types of positions and fields of work which graduates are qualified to fill; and to consider what records, supplementary to the usual scholastic record, are best designed to facilitate the employment of graduates.

d. To indicate how methods of recruiting and developing engineering teaching staffs may be improved.

To these ends it is the purpose to learn from what sources teachers of junior and senior rank are being drawn or may be drawn; to learn what methods are in use for developing younger teachers and how such

methods may be made more effective; to determine how adequate contacts of teachers with industry and practice may be afforded; and to examine into the mutual responsibilities of the colleges, the industries and the profession for the development and maintenance of teaching staffs of a high order.

IV. *It is the intention to examine the practicability and possible benefits of closer group relationships among the colleges and with the professional organization of engineers:*

a. To indicate the extent to which further development of group action by engineering colleges is desirable, and to point out how such action may effected.

To this end studies are in progress of the policies and activities of the organized groups of professional schools and colleges. It is believed that much can be learned as to effective means of initiating and carrying out concerted policies through an appreciation of methods used and results attained by other group organizations of colleges.

b. To determine how the engineering colleges and the professional organizations of engineers may effect a closer association for the mutual benefit of engineering education and the profession of engineering.

V. *It is the intention to make an analytical comparison of the organization and practices of engineering education in Europe and America:*

a. To compare the positions occupied by the engineering colleges in the educational systems of their respective countries.

b. To compare the educational practices of the several groups of institutions relative to admission standards, teaching and examination methods,

curricula, the development and status of teachers, and the like.

c. To compare the relations of the several groups of institutions to the industrial life, the governmental and public services, and the professional organizations of engineers of their respective countries.

(These studies will be begun by a visit of the Director to Europe in the first half of 1925.)

Procedures of the Investigation.

The several phases of the investigation are being carried out in the following steps:

1. Survey of the situation.

   This fact-finding process is now in progress through coöperation of committees of the colleges, the United States Bureau of Education, the Joint Advisory Committee with the National Industrial Conference Board, the engineering societies, and other agencies. The collection of the information is being carried out through a number of definitely formulated projects.

2. Analysis of the facts and their presentation in systematic order.
3. Interpretation of the evidence.
4. Experimentation, where desirable, upon the basis of the facts ascertained.

   It is contemplated that experimental projects will be formulated and invitations to conduct them extended when sufficient evidence has been gathered to indicate the basis of such experiments.

5. Presentation of a comprehensive summary of the foregoing investigative processes.

   This will be in the nature of a report or reports on the initial stages of the investigation.

As the results of the investigative processes become available it is the expectation that the general project will develop

naturally into a concerted effort on the part of the colleges of engineering to effect the needed adjustments of their curricula and educational methods. As the emphasis shifts from investigation to development, the initiative is expected to pass more and more to individual institutions. There should be a period of study and discussion of the situation by faculty committees and in faculty meetings, from which conclusions should be reached and plans for action formulated. As the plans are put into effect, their results should be observed. It is not the aim to bring the project to a definite stage of conclusion, but rather to prepare the way for a continuing process of educational inquiry and adjustment, and to develop within the Society's organization the means of making the coöperation of the colleges in this process effective.

(Signed) CHAS. F. SCOTT, *Chairman*,
F. L. BISHOP, *Secretary*,
WM. E. WICKENDEN, *Director*.

December 6, 1924.

REPORT OF THE DIRECTOR OF INVESTIGATION, TO THE BOARD OF INVESTIGATION AND CÖ-ORDINATION, DECEMBER 5, 1924.

The months of October and November have been devoted principally to visits in the field; to the building up of contacts with coöperating agencies other than the schools; to conferences with influential advisors; to the building up of contacts in anticipation of the coming survey in Europe; to the preparation of memoranda for file records covering the preliminary results of studies in progress; to the preparation of a provisional report on the relations existing between the professional organizations and professional schools in fields other than engineering; to preliminary work on the formulation of the objectives of the general project; to establishing a routine and an index system for the circulation of reprints and circular publicity material; to the active prosecution of a study of group organizations of colleges in various educational fields; and to long and short range planning with the Associate Director.

Visits and Addresses Made.—The Director attended the centennial exercises of the Rensselaer Polytechnic Institute and made valuable contacts with educational and professional delegates from the United States, Canada, and several European Countries. Visits have been made to thirteen engineering colleges in addition to the above, principally in the north central and Missouri Valley regions and in Canada. Important conferences with engineering faculties, special committees of investigation and with administrative officers were held at each institution. Large student groups were addressed at three institutions. The Director addressed the united engineering societies of St. Louis and of Toronto, and shared in a conference of influential engineers and industrial leaders of St. Louis, relative to the development of engineering education throughout the southwest and at Washington University in particular. The Director attended the fall

meeting of the Kansas-Nebraska section of the Society and addressed the gathering.

Visits had been scheduled for this period to institutions in Colorado, Utah, Montana, Idaho, Washington, Oregon, California, Arizona, Texas, and Oklahoma, in addition to those actually visited, but it was found necessary to postpone these appointments until a later period, because of the necessity of giving attention to general matters at headquarters. It is hoped that the Associate Director will be able to cover much of this territory early in 1925.

Contacts with Coöperating Agencies.—Contacts have now been established by correspondence and circular information with practically all of the engineering and semi-engineering societies of a national character and with many of the larger societies of a regional or local character. Definite coöperative work has been proposed to the major national societies which will enable each of them to make its own distinctive contribution in addition to that made through the activities of the educational counsellors and secretaries in the joint conference group. Coöperative work has been proposed to seventeen of the national societies of a more specialized character. The nature of these proposals is indicated by the accompanying exhibits.

Plans for contact through circular information have been made to cover a large group of regional and local organizations, but it has not been practical so far to propose definite plans of coöperation to them.

There have been no direct contacts with the joint conference group of the national engineering societies. A study of the relations of other professional organizations to the corresponding groups of professional schools, which was sponsored by this conference group, has been carried to an advanced stage and will be circulated as a provisional report upon its publication in the December Journal of the Society. Reprints of this report will be transmitted to the members of the joint conference group, together with a letter advising them of the general progress of the work and pointing out

that the studies sponsored by the group will probably be brought to a focus on definite issues, with the concrete data needed for their consideration by the fall of 1925, at which time it is hoped that a meeting of the group may be held. In the interim it is the intention to push the work sponsored by this group and to send them periodic news letters on the progress of the studies in America and in Europe. The Director acknowledges with the highest appreciation the counsel of Mr. Calvin W. Rice, Secretary of the American Society of Mechanical Engineers, in relation to this work and particularly in making important contacts for the studies abroad.

Satisfactory contact is being maintained by correspondence and by conference with the Committee on Coöperative Relations with Universities of the American Railway Engineering Association. This Committee has launched active work on a survey of the present supply of trained men in the railroad organizations, of their recruiting policies and methods, and of the needs to be met by a more active policy and program.

Contacts with the National Industrial Conference Board in the period has been only incidental, it being evident that their work was making satisfactory progress along highly valuable lines.

Contact with the Bureau of Education has been maintained by two visits to Washington, by a conference with Dr. John in New York, and by correspondence. Progress on the statistical surveys of engineering curricula and of attendance at engineering colleges is satisfactory. The Commissioner of Education has supplied the Director with official credentials of introduction to the Ministries of Education in the European countries to be visited.

Conferences.—Conferences on the general plan of the work and the formulation of its objectives have been held with Dr. Keppel and Dr. Pritchett. Conferences on particular problems encountered have been held with Mr. Furst of the Carnegie Foundation, Dr. Farrand of the Commonwealth Fund, Dr. Mann of the American Council on Education, Dr. Kelly of the American Association of Colleges and The Church

Boards of Education, Dean Seashore of this Board, Professor Chapman of Yale, Professor Thurstone of the University of Chicago and Mr. Wallace of the American Engineering Council.

A conference of considerable length was held with Dean Johnson of the University of Maryland, President of the American Association of Engineers, Mr. Frederick Newell, Past-President of that Association and Mr. A. B. McDaniel of its membership. On behalf of the said Association these representatives urged that the Board undertake a project for the classification of engineering positions under the many national, state and local regulatory commissions concerned with public utility services, and for the preparation of minimum specifications for men to fill such positions, along the lines of the Bulletin of the National Research Council entitled "Minimum Specifications for Highway Engineering Positions" which was prepared by Mr. McDaniel.

Publications.—Within the period covered by this report the publications of the Director have been as follows:

"A Report of Progress and of Plans for Future Action,"
JOURNAL OF ENGINEERING EDUCATION, September, 1924.

"College Education and Professional Training,"
JOURNAL OF ENGINEERING EDUCATION, November, 1924.

(Signed) W. E. WICKENDEN,
Director of Investigation.

EXHIBIT.

Communication Addressed to the Founder Societies.

In common with all rapidly expanding fields of knowledge and activity, engineering is undergoing a progressive subdivision and specialization of work. The main divisions of engineering remain fairly distinct, but there are few, if any, general civil engineers, electrical engineers or mechanical engineers corresponding to the general practitioners in medicine or law. These engineering titles are much less definite guides to the educator than they once were. The term civil engineer, instead of defining a person, now defines a varied group. If the duties and functions of engineers are to furnish patterns for an educational program, somewhat more

detailed descriptions than these very general historical titles seem to be needed.

It is far from clear what degree of specialization is needed in the engineering courses of study. No one wants premature specialization, and no one wants to see the fundamentals common to all engineering slighted. The present investigation will include an inquiry into the nature and extent of this common foundation. It seems fitting also to raise the question as to the major and minor subdivisions of engineering to be recognized in planning that part of the engineering courses which goes beyond this general foundation.

Partly because of a desire for broad training, partly because of the difficulty of selecting a definite division of engineering while still a student, and partly because many young men study engineering without the intention of becoming engineers of a professional type, it is probable that many students can best be served by a course of study with a minimum of specialization. There are others, however, who have well chosen objectives which they ought to be able to follow up in greater detail.

Would it be practicable for the American Society of Mechanical Engineering to contribute to the inquiry into the subdivision of engineering activities, which may serve as a guide in planning educational programs, by supplying answers to the following questions:

1. Into what major divisions of engineering practice is mechanical engineering divided?
2. What are the relative proportions, preferably expressed as approximate percentages of the whole group of mechanical engineers, of the men engaged in these several divisions?
3. Which of these divisions deal with matters of such general importance that some attention should be given to them in the training of all mechanical engineers?
4. In which of these major divisions should distinctive programs of training be provided for a considerable number of students?
5. Should the distinctive training referred to in (4) above be provided for in all, many, or a few institutions having departments of mechanical engineering?
6. In which of these programs of training, if any, is it necessary to supplement the work which can be given in college with an organized program of introductory experience?
7. In which of these programs of training can the necessary

introductory experience be obtained without an organized process?

8. Are there still more highly specialized divisions of the mechanical engineering field for which training ought to be offered in one or more institutions?

As a second stage of inquiry to be undertaken later, it is hoped that facts may be gathered which will indicate the particular educational requirements in each of these major subdivisions of the field.

EXHIBIT.

Communication Addressed to a Group of National Engineering Societies.

We are gratified to have your assurance of the interest and coöperation of the American Society of Refrigerating Engineers in this general investigation of engineering education.

One of the features of the work which is assuming great importance is the survey of the occupational demand for engineering graduates. This is a division of the work of which your Society may be able to make a distinctive and valuable contribution. Would it be practicable for a committee to work up an answer to any or all of the following questions:

1. How many graduates of engineering schools should be definitely pointed to your special field each year to meet reasonable demands without overcrowding?

2. What specific training, in addition to the foundation subjects common to practically all engineering courses should the above mentioned group receive?

3. What training bearing directly upon your field should be given or offered to the general body of students in the mechanical engineering course or other courses?

REPORT OF THE ASSOCIATE DIRECTOR OF INVESTIGATION TO THE BOARD OF INVESTIGATION AND COÖRDINATION, DECEMBER 5, 1924.

Since the September meeting of the Board attention has been devoted chiefly to inauguration of the program of studies to be undertaken by Faculty Committees. Three studies which were prepared during the summer months relating to entering students, to admissions and eliminations and to graduates and former students were sent to a considerable number of committees with invitations to undertake any or all of them. The response to this invitation is given in detail later in this report. It may be said in brief that there is little doubt that all of the information which the studies were designed to furnish will be secured. In fact, data has already arrived at this office in considerable volume and in excellent form.

Attention has also been given to the preparation of the studies relating to teaching personnel and to the services and facilities of the engineering colleges. Conferences have been held with the chairmen and secretaries of the committees of the Society to which these studies have been assigned. It is expected that the studies will be ready for submission to the Faculty Committees shortly after January 1st.

Considerable attention has been devoted to the formulation of plans for carrying on the work in the absence of the Director in Europe during the first half of 1925 and to preliminary work upon the statement of Objectives of the Investigation. Systems of record keeping and filing have been devised and put into effect with the purpose of dealing systematically with the large bulk of statistical material which committees are furnishing. An additional stenographer, Miss Viola Deubel, has been engaged in order to relieve the office secretary of an overburden of correspondence and typing.

All of the office routines are now handled promptly and efficiently, and it is possible with our own staff to deal with a considerable amount of work which formerly had to be done by public stenographic agencies.

Special Investigations.—The committees of the faculties of the Case School of Applied Science, the Ohio State University, and the University of Cincinnati were invited to undertake a special investigation along similar lines, with the purposes of ascertaining the distinctive characteristics and results of engineering education as conducted by three types of institutions in the same environment. This invitation was accepted by the three committees for their respective institutions and the preliminary work of the project is well under way. Special mention should be made of the spirit of cooperation in which this work has been undertaken by the three committees.

The Harvard Committee has been invited to consider the possibility of preparing a statement of criteria which should underlie the selection of subject matter and of the fundamental principles which should govern methods of instruction in engineering courses.

The honorary fraternity of electrical engineering—Eta Kappa Nu—has generously offered to undertake the collection and analysis of opinions and experiences of its graduate members upon certain phases of electrical engineering courses, with special emphasis upon the teaching of economics and the need for training in the principles of economics in courses in electrical engineering. Plans for special studies of a similar type but in other divisions of engineering curricula are under consideration.

Visits and Conferences.—Meetings of the New England Section of the Society and of the Engineering Division of the Association of Land Grant Colleges were attended. Opportunity was afforded at these meetings to confer with representatives of a number of Faculty Committees. A conference was also held with Dr. Walton C. John of the United States Bureau of Education. Opportunity was afforded in connection with the annual meeting of the American Society

of Mechanical Engineers to confer with chairmen of committees who were attending the meeting.

Visits were made to fifteen institutions and conferences held with committees in each of them. Visits are planned in the near future to nine additional institutions.

A conference was held with the chairman and secretary of the Committee of the Society on Engineering Students and Graduates at which the present state of the work on the projects assigned to that committee and plans for the further development of the projects were discussed. Several attempts have been made to meet with the chairman and secretary of the Committee on Admissions and Eliminations, but conflict of other engagements has thus far prevented such a meeting. It is planned to confer with the chairman and secretary of this committee shortly after January 1st.

An invitation to address the annual meeting of the Engineering Institute of Canada on January 28, 1925, has been accepted. This trip will afford opportunity to meet with committees of Canadian and New England institutions.

It is hoped that the Associate Director will find it possible to visit institutions in the West and South which the Director had planned to reach prior to his department for Europe.

Publications.—Since the last meeting of the Board a report entitled "Progress in the Society's Investigation of Engineering Education" has been published in the November issue of the JOURNAL. It is planned to keep the Society membership informed as to the progress of the work by similar statements in the JOURNAL from time to time.

Data Relative to Studies in Progress By Coöperative Committees.—The following is a brief summary of the present status of the work of the coöperative committees of the faculties.

101 colleges have appointed coöperative committees. One college has withdrawn from the undertaking after sending in some of the data. Since the preparation of the list of cooperating institutions, which appeared in the November issue of the JOURNAL OF ENGINEERING EDUCATION, committees have been appointed in the following institutions:

University of Arizona,
Bucknell University,
The Citadel,
Georgia School of Technology,
Missouri School of Mines and Metallurgy.

67 committees have sent formal notification of program of studies which they have undertaken.

The number of committees which have undertaken the various divisions of the studies is as follows:

30 Aa1—A Study of Entering Students,
47 Aa2—A Study of Admissions and Eliminations,
* 2 Aa3—A Study of Students Other than Freshmen,
29 Aa4—A Study of Graduates and Former Students,
* 3 Ab1—A Study of Teaching Personnel,
* 3 Ac1—A Study of the Services and Facilities of Engineering Colleges,
12 Da3—Experiments with Placement Examinations,
5 Da4—Diagnostic Study of Cases of Impending Failure.

(* These studies have not been sent to any considerable group of institutions, but a few committees have undertaken them independently.)

Reports thus far received from committees are as follows:

Aa1—Form 1C	4
Aa2—Form 2A	32
Form 2B	29
Form 2C	5
Da3—Placement examination scores	3

(Signed) H. P. HAMMOND,
Associate Director.

"SELLING" ENGLISH AT IOWA STATE COLLEGE.

A. STARBUCK,

Associate Professor of English at Iowa State College.

There has been everywhere during the past few years a growing interest in the importance of adequate language training; and year by year in a larger number of engineering colleges such training has come to be looked upon as a necessary condition of graduation. Just where and when this movement began, it would be hard to say with definiteness. Until recently there has been no well defined plan for encouraging it. Those of us who have been watching the Committee on English of the Society for the Promotion of Engineering Education recall that it was not until two years ago at the Urbana meeting that conditions seemed to justify the committee in calling the first general conference of teachers of English to engineers. Between that first conference and the one at Boulder, where the subject of English was considered of sufficient importance to engage the attention of the deans and executive officers through an entire session, there has intervened only one annual meeting of the society.

But the approach of English to a place of importance in

Note. If every engineering college in the United States had only a group of teachers of English with the keen appreciation of their opportunities for high service to engineering education, the unity of purpose to realize those opportunities, and the contagious enthusiasm for their task which characterizes the teachers of English at Iowa State College, the Committee on English would need only to sit complacently by smiling as it saw its millenium approaching. There are, to be sure, an increasing number of such groups. There will be more, who will commit themselves thus wholeheartedly to the cause of engineering education. Meanwhile such evidence as that afforded by Professor Starbuck's narrative is suggestive and inspiring.

J. RALEIGH NELSON, *Chairman of Committee on English.*
The Committee on Students' English,

the counsels of engineering educators has not been so rapid or so spectacular as these two conferences taken by themselves suggest. It has been a spontaneous movement, widespread and of slow growth. It has developed out of the logic of the situation and gives, therefore, some promise of permanence.

In each institution the development of a better language morale has varied according to local conditions. Perhaps a typical instance of the movement is what has occurred during the past few years at Iowa State College. Little has been said in a public way about this achievement; but when what has been done there is thought of as merely representative of a movement which is still gaining headway over the country, it becomes really significant.

So thoroughly has the ideal of better language training taken root at Iowa State College that it would be difficult to enumerate everthing which has contributed toward making the subject of language study appear worth while to the student body. There are two factors in the situation, however, which are fundamental; and there are two others which are important enough to warrant some consideration. The first two are the work of the engineering Committee on Journalism and Languages and the development from it of the all-college Committee on Students' English, topics which are discussed in the present paper; the second two are the publication of *Ames Narratives* and the display of an English booth at the time of the all-college celebration last spring, topics to be treated in a later issue of the JOURNAL.

The Committee on Journalism and Languages was organized in response to criticism of the language of Ames engineers who had become sufficiently prominent in their profession to attract attention to their speech and their writing. This criticism came partly from those graduates who themselves realized their own weaknesses; partly from Ames alumni who were sufficiently trained in language to recognize the deficiencies of their fellows; and partly—and perhaps most effectively—from industrial and business leaders, employers of Ames graduates, who found certain of them without the

training in language adequate to fit them for the duties for which their technical preparation had prepared them.

This situation had for some time been the source of concern to Dean Marston of the engineering division and to his cabinet, consisting of the heads of the various engineering departments. Soon after the close of the war, when Dean Marston had returned to Ames from military service, he had begun a survey of teaching within the engineering college. During the school year of 1919–20 there had seemed sufficient interest to warrant some formal recognition of the English problem; and so, near the beginning of the following year, on October 14, 1920, Dean Marston mailed to members of the engineering faculty a request that they should "make each student report, solution of problem, or examination paper an exercise in English." Early in 1921 the dean, with the approval of his cabinet, appointed a body which was at first known as a liaison committee, but which later, when war terms went out of fashion, came to be called the Committee on Journalism and Languages.

This committee was composed of three representatives from the engineering division, the head of the engineering group of English teachers, and a representative from each of the departments of agricultural journalism, modern languages, physics, and public speaking. Soon after the organization of the committee the chairman, an engineer, because of other work found it necessary to retire from active participation in its duties. His successor was the English representative on the committee, who first as acting and then as permanent chairman has since directed the work of the committee.

This committee was instructed to investigate the whole field of expression as it related to Ames undergraduate engineers and to make such recommendations as seemed wise. In pursuance of its instructions the committee began a systematic canvass of the language situation in the division of engineering. It discovered throughout the division an increasing emphasis on better language habits, an emphasis which mani-

fested itself independently of any formal action of the committee in a number of steps looking toward an improvement of language morale. From the department of electrical engineering two seniors were challenged for deficiencies in English. One of these had come from another school, with provisional credit for freshman English work but not for the two-hour sophomore course in argumentation required at Ames. His English technique in this course was so poor that his instructor on advice from the head of the student's department assigned him to an additional course in English. The other case was similar except for the fact that the student has passed through the Ames freshman courses with low marks and thought he was "through with English."

From the department of mechanical engineering students were similarly held up for language deficiencies. From other departments in the division, also, the same insistence on improved language habits was developing; and the time seemed ripe for a definite proposal. On June 6, 1921 the committee decided to make two recommendations to the engineering faculty: the first was that the engineering faculty should employ an English expert to serve as the chairman of a committee to have charge of all matters relating to the English of engineering students; the second was that the engineering faculty should recommend the plan to the general faculty for adoption by the entire institution.

It was exactly eighteen months before these two recommendations, practically unchanged, actually reached the engineering faculty. But in the meantime there had been quite general informal discussion of them. By this time, too, the improvement of students' English had become a matter of such active and such widespread interest as to get beyond the bounds of the engineering faculty. Before the recommendations of the committee reached the engineering faculty, leaders of the other college divisions had indicated a willingness to have the discussion of the problem transferred to the general faculty with the idea that such action as seemed wise should be taken for the college as a whole. The approval which the

engineering faculty gave the plan of the committee on December 6, 1922, was, therefore, largely a matter of formality, and there was little open discussion.

But there was no more disposition to hurry the matter before the general faculty than there had been before the engineering faculty; and the same sort of informal discussion on a larger scale preceded formal action. In the course of this discussion the engineering Committee on Journalism and Languages, without losing its identity or functions as a committee of the engineering faculty, was merged in a temporary all-college Committee on Students' English. Under the leadership of this committee, also, the original plan was modified by omission of the part calling for an English expert and by provision for an organization of faculty members representing the college as a whole, the different divisions of the college, and the various departments within the divisions. As recommended to the general faculty and adopted with very little open discussion just before commencement, 1923, the system provided for an all-college Committee on Students English consisting of seven members; representatives of the English department as Divisional English advisers for each of the five divisions of the college; and thirty-seven members of the technical faculties, none of them teachers of English, representing, with a few combinations, each of the departments in which students can do major work. This gives a total, excluding duplicates, of forty-two members of the faculty who are officially charged with responsibility for encouraging language morale among students.

With the deliberateness which has characterized the movement from its inception and which doubtless accounts in large part for the unity of sentiment concerning it, President Pearson delayed the appointment of the permanent Committee on Students' English until November 20, 1923. It was agreed all around, since the purpose of the new organization was to "sell" English to the college student, as the purpose of the Committee on Journalism and Languages had been to "sell English to the engineering student, that it would be better,

here as there, to have as chairman of the Committee on Students' English some one whose interest in English training was keen but who was himself not a member of the English department. But it was felt, also, that the English department should be kept in close touch with the activities of the committee. The president, therefore, appointed as chairman of the committee a member of the department of vocational education, and the committee at its first meeting elected as secretary the head of the engineering group of English teachers.

The system operates as follows: any instructor who observes poor English in the work of any student may consult the departmental English adviser, and together they may decide what action to take. This action may range from merely cautioning the student, to referring him to the Committee on Students' English for additional work. Action on cases referred to the committee is taken only after unanimous vote.

It is too early to estimate the permanent value of the new organization. In the spring of 1924 ten cases came before the committee. Of these, two were from the graduate college, four from the senior college, and four from the junior college. In November, 1924 there were reported ten additional cases from three of the five major divisions of the college. This number seems trivial. But those in closest touch with the situation count this small number as one of the surest indications that the system is working. It is the object of the plan so to stimulate interest in language proficiency as to make it unnecessary for any student to do other than the regularly prescribed work in English, oral or written. It is not expected that this aim will actually be attained in full measure. But there can be no doubt that the subject of language proficiency has been "sold" to the great majority of the members of the technical faculties. The Committee on Students' English encourages the instructing staff to handle cases whenever practicable either directly with the student or in coöperation with the departmental English adviser, without formal reference to the committee; and there are indications

that a great deal of work of an informal nature has been done. It is the intention that only cases really serious shall be referred to the committee.

There are indications, also, that the subject of language proficiency is being "sold" to the student body. Its importance is being put in terms that the most obtuse can understand. English teachers are perhaps in better position to get a general view of the situation than teachers in many other departments; and constantly English teachers have had reported to them by their students that this technical instructor or that has said his department will no longer graduate students who are notably weak in ability to use the language. This does not mean, of course, that the troubles of the English teacher are over. The problem of instruction remains as it was before. But the teacher is guaranteed an audience present for the most part mentally and well as physically; and he preaches not to deaf ears as once he did, but to those who in the insistence of their own technical instructors have found the surest motivation for a study of the mother tongue.

The work of the engineering Committee on Journalism and Languages and the development from it of the all-college Committee on Students' English together with its assisting organizations, are outstanding features in the effort to give English training its proper place at Iowa State College. But this account ought not to close without mention of two others. For a number of years the home economics division and the home economics group of English teachers have carried on a thoroughgoing bit of coöperative work. In the spring of 1923, also, at the request of the department of civil engineering the members of the engineering group of English teachers criticized the reports which a class of seniors made after inspecting Skunk River bridge near Ames. The language problems encountered in these reports were tabulated and made the basis of a two-hour conference and discussion with the class led by both English and technical instructors. This work for its promise and that with the home eco-

nomics division for its actual achievement, while they are matters primarily of coöperative teaching, have had an important bearing on the impression which the student gets concerning the value of language training. They may be counted, along with the work of the committee on Journalism and Languages and the development of the Committee on Students' English, as factors in the coöperative "'selling" of English to students of Iowa State College.

THE NEW COÖPERATIVE OPTIONS IN THE ENGINEERING COURSES AT NEW YORK UNIVERSITY.

J. W. ROE,

Professor of Industrial Engineering.

The advantages of the coöperative plan in engineering education have been presented from time to time at the meetings and in the publications of the Society for the Promotion of Engineering Education as well as elsewhere.* It is not necessary therefore, that the broad principle be reviewed here. One thing, however, is not realized as widely as might be desirable, namely that the coöperative plan is flexible and is more capable of variation to suit local conditions than is generally supposed. Despite its great success as developed by Dean Schneider at the University of Cincinnati, it was a number of years before other institutions adopted it and at first its development elsewhere was slow.

The essential principle of the system is that the engineering student obtain his practical experience during his college course and in actual practice, under actual working conditions, by means of alternating periods in industry and in college. The length of these periods is not essential to the broad principle. This varies in different engineering schools from one week to four months. Also there is a variation in the amount of time given coöperative work, to the place where it enters into the course, and to the length of the course. None of these variations affect the essential principle, namely that the practical experience be acquired in actual industry, on a basis of alternation, prior to graduation. As an example of the above it may be pointed out that the University of Pittsburgh has for 14 years used the coöperative plan with a three-

* Attention is called to the article on "The Coöperative Plan in Engineering Education" which appeared in *Management Engineering*, May, 1922. This article reviews the history of this plan in the various institutions which have adopted it, the various forms used, its advantages, and the experience with this plan up to the year 1922.

month alternating period throughout the sophomore and junior years of a four year course. The Massachusetts Institute of Technology uses it in a five-year course for their electrical engineers, with the three-month periods through the third, fourth and fifth years. The Harvard Engineering School uses it in a four-year course, with two months alternation through the junior year and the summer following. In all of these applications the class is divided into A and B sections which interchange between industry and the college.

In 1922 New York University adopted the coöperative plan for its four-year course in Industrial Engineering on the basis of four months periods. Here, however, the alternation was between the junior and senior classes as a whole, not between the A and B sections of the same class. Such an arrangement would be of little advantage at an institution like the University of Cincinnati where the number of students is now so great that multiple teaching sections are necessary. Where this is true, it makes little difference in the cost of teaching, whether these sections be given, to use an electrical term, in multiple or in series. For smaller institutions, however, the plan of exchanging classes obviates the necessity of teaching everything twice. The four-month periods at New York University begin approximately on October 1st, February 1st and June 1st, thus coinciding with the first and second semesters of the college year. The four-mouths period, therefore, has a distinct advantage in that the periods in college coincide with the natural subdivision which obtains in the other courses. This is of course of advantage in handling those subjects which are taught in common with other courses not on the coöperative basis.

The experience with the coöperative plan at New York University has been so favorable that it has been decided to extend the plan to all of the other courses in the College of Engineering. It was felt necessary that this should be done on an optional basis as both students and the general public are as yet not sufficiently familiar with the advantages of

the coöperative plan; and to place the whole college at once on a required coöperative basis would mean an inevitable and sharp drop in attendance for at least a number of years.

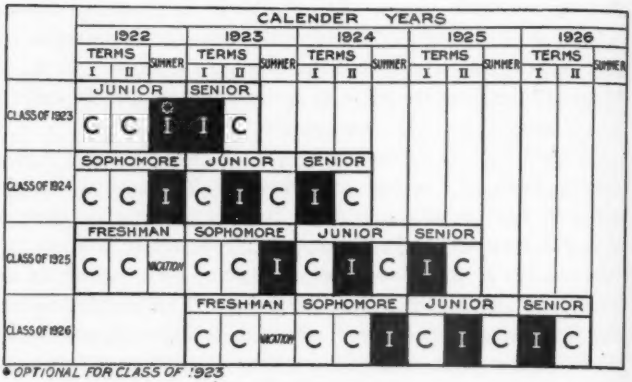


FIG. 1. Coöperative plan for the industrial engineering course at New York University, 1922.

When the plan was introduced on an optional basis at the University of Cincinnati, 27 students elected the coöperative basis and 107 the regular basis. It was four years before the number of students taking the coöperative courses passed those taking the regular courses. Figure 1 shows the plan as adopted for the Industrial Engineering course in 1922. It will be seen that the student begins coöperative work in June at the end of the sophomore year and is either in industry or at college continuously until graduation, with the exception of the one week's vacation which was arranged at each change point. It will be noticed also that the student is in industry in the second term of the junior year at college, that he is taking the full college term during the summer immediately following and is in industry again the first term of the senior year. The junior and senior years are therefore somewhat out of step with a regular four-year course. There are

two terms when college is running and the coöperative students are in industry and one summer term when the regular students are away and the coöperative students are under instruction.

It was therefore decided to adopt the form shown in Fig. 2. In this diagram the upper line represents the regular four-year course leading to the B.S. degree in the branch of engineering studied. The engineering degree can be obtained after

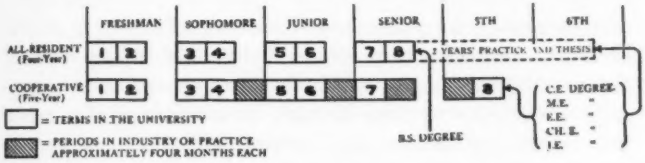


FIG. 2. Comparison of all-resident and coöperative courses.

two years of practice and the presentation of a satisfactory thesis, that is in June of the sixth year from entrance. The coöperative course is shown in the second line. This leads to the engineering degree at the end of the fifth year. It is so arranged that the coöperative students and the regular students are following the same course with no change whatever up to mid-year of the senior year. The coöperative students will then go into industry for their third coöperative period and will take their eighth college term the following year as indicated. The shaded areas represent periods in industry. The open space shown in the summer of the senior year is deliberatively provided as a "take up" for contingencies. One of the troubles experienced with the form shown in Fig. 1 was a certain amount of inflexibility. If for any reason a student failed in some subject and had to repeat it, or if he were ill for some time, there was no chance to make up the work. This open summer provides it. If the student desires and is in good standing he will be encouraged to work through this summer thus putting in a full year from mid-years of the senior year to mid-years of the fifth year.

This arrangement gives a coöperative student full opportunity to engage in all the undergraduate life, athletics, etc., open to the regular students. The only difference is in the second term of the senior year, and what he loses there is made up by his presence in college in the corresponding term of the following year. A student can elect the coöperative course and if for sufficient reasons it is necessary for him to graduate in four years he can take the eighth term with the regulars and graduate with the B.S. degree. He would, however, have had the advantage of the two summers in industry. The choice between courses is required before June of the second year. A regular junior may change to the coöperative course by working through the summer of the fourth year in place of the first period which he would not have had. A man might even change from the regular to the coöperative course at the end of the seventh term by taking three periods of coöperative work between the seventh and eighth college terms and putting in his fourth working period during the summer of the fifth year. The plan seems to have the extreme of flexibility. From the standpoint of the University it requires no change in teaching whatever. The option can be thrown open to a class and it makes no difference in the regular instruction whether all but one stay in the old course or all but one go into the coöperative work or for any combination between these limits. It is frankly recognized that this is not wholly ideal from the coöperative point of view. During the summer two groups, the first and second group, would be out together. The long absence from college between the seventh and eighth terms and from industry during the fifth and sixth terms are recognized as undesirable in some ways. It is recognized also that some students will become restive at the end of the seventh term and want to take their eighth term at once and get into industry as soon as possible. It is felt that this can be largely met by advising such students to get into their permanent employment at the end of the seventh term. The coördinating department will

undertake to secure a leave of absence of four months to enable them to take the eighth term. It is planned that during this term thesis work will be strongly emphasized and it will be pointed out to the employer that this time can be spent on a research problem connected with the industry so that the period may be made of value to him as well as to the student.

The student at graduation from the coöperative course will be farther advanced and stronger professionally than he would have been if he had taken the regular course, as he will have covered the full content of the four-year course and have had in addition not less than one year and four months, possibly one year and eight months of supervised, directed, practical work as against the one year of undirected and unsupervised work after graduation from the regular course. Regular tuition will be charged the student only for those periods passed in college. A small fee for supervision will be charged during the coöperative periods but this can be easily carried by the earnings during those periods. From the experience it is reasonable to expect that the student can support himself during the coöperative periods and in the later periods possibly save something toward his college expenses. It will therefore be possible for him to take the five-year course leading to the engineering degree at no greater, or even a less, net cost then the regular four-year course leading only to bachelor's degree. It is felt that while this course is not ideal it has features of very great value as a transition course which can be used in an institution teaching the present type of "all resident" course, that it incorporates the essential advantages of the coöperative plan and offers opportunity to try it out without change in the teaching program or increased administative expense other than that involved in the coördination, which may be covered in part by moderate fees charged during the coöperative period. Such a course as this may make possible the use of the coöperative plan in institutions which do not feel free to adopt other forms.

THE LAMME AWARD.

WESTINGHOUSE ELECTRIC AND MANFACTURING COMPANY.

LEGAL DEPARTMENT.

Office of
JOHN J. JACKSON *General Attorney*

EAST PITTSBURGH,
December 23, 1924.

Mr. F. L. BISHOP, Secretary,
Society for the Promotion of Engineering Education,
University of Pittsburgh,
Pittsburgh, Pa.

Dear Sir: The will of the late Benjamin G. Lamme contains the following provision:

> I hereby authorize and empower my said executors and trustees to pay over to or place in trust for the Society for the Promotion of Engineering Education, or some other suitable body acting for the technical schools of this country (the beneficiary of such trust to be selected by my said executors and trustees), the sum of Six thousand dollars ($6,000) of which an amount not exceeding One thousand dollars ($1,000) shall be expended for a die and the balance shall be held as a trust fund, the yearly income from such fund to be expended for a suitable gold medal (together with a bronze replica thereof) to be given yearly to a chosen technical teacher for accomplishment in technical teaching or actual advancement of the art of technical training. If the accumulation of said trust fund, in the judgment of said beneficiary warrants, then in some years two medals may be given. No individual shall receive such medal more than once.

In accordance with this provision the Executors will be pleased to make the Society for the Promotion of Engineering Education the organization through which the award of the medal is to be made. The formal transfer of the funds,

however, must await the further progress in the adjustment of the estate.

The Society may properly form its plans for the award of the medal, and it would be proper for it to arrange for the first award at the time of its Annual Convention in June, 1925, if it so chooses.

Yours very truly,

(Signed) R. S. FIECHT,
JOHN J. JACKSON,
FLORENCE A. LAMME,
Executors.

BENJAMIN GARVER LAMME.*

ELECTRICAL ENGINEER—PIONEER, LEADER, EDUCATOR.

BY CHARLES F. SCOTT.†

Professor of Electrical Engineering, Yale University.

To Alumni of Ohio State University, the career of Benjamin Garver Lamme (1864–1924) is of peculiar significance, for among fifteen thousand and more of us he was unanimously designated by the Board of Award to receive the first "Joseph Sullivant Medal" ‡ in recognition of the value of his work to the world.

He was Chief Engineer of the Westinghouse Electric and Manufacturing Company. He had received the Edison Medal, awarded annually by the American Institute of Elec-

* Reprinted from *Ohio State University Monthly*, October, 1924.

†No one is more competent to evaluate the life work of Mr. Lamme and none could, with finer appropriateness, pay deserved tribute to his memory than Professor Charles F. Scott, his associate and friend. Mr. Scott is himself an outstanding figure in the field of electrical engineering development and education. The son of Dr. W. H. Scott, former president of the University, he received his A. B. from Ohio State in 1885, two years after his father became president of the University. While in school he served as a student assistant in Physics under the late Dr. Thomas Corwin Mendenhall,—a fact which is evidence of his capability as an undergraduate. Professor Scott began his work with Westinghouse company in 1888. His rise was rapid. In 1904 he was given the title "Consulting Engineer" with this company. In 1911 he went to Yale.

Professor Scott is a former president of the Society for the Promotion of Engineering Education and of the American Institute of Electrical Engineers. The "student branches" of the latter organization, now established in the leading engineering schools throughout America, were his idea. The famous Engineering Societies Building in New York City was made possible through the gift of Andrew Carnegie who was impressed by the usefulness of such a building as suggested by Professor Scott.—Editor *Ohio State University Monthly.*

‡ This is a University Medal, established by Dr. T. C. Mendenhall, formerly Professor of Physics and during the last years of his life a Trustee of the institution.

trical Engineers for electrical achievement. He had been one of its two representatives on the Naval Consulting Board during the war, serving as Chairman of the Inventions Committee which directed investigations and passed upon hundreds of schemes for the detection and destruction of submarines. These testify to his standing in his own profession as an engineer and inventor. But the Joseph Sullivant Medal brings in every field of activity in which graduates of more than forty classes are engaged; and the award went not to science or to art but to engineers, and to Lamme.

It would be interesting to consult the Class Day prophecy of 1888 to note the career predicted for a member who held first rank in his classes but was little known outside the engineering group,who figured in no major or minor sports, who belonged to no fraternity or literary society, who took no part in social affairs, who was quiet and retiring, of few words and with nothing in appearance or manner indicating intrinsic capability. But the man ranking low in many qualities often counted essential to success, won in life achievement. Why?

Many may imagine that an electrical engineer and inventor of pre-eminence must be a wizard of some sort; but he had no occult powers, he was no visionary. He was simple and unassuming in manner and mind and method. His magic wand for transforming new ideas into realities was a trained mind. He could think clearly, analyse a problem into its fundamental elements, proceed directly from cause to effect or vice versa. He had vision, persistence, purpose. He was a productive thinker because he worked many hours and with high efficiency.

My own recollection of student days gives a clew to his success. In the fall of '85 (I had received my A.B., in June) I took Analytic Mechanics with the engineering juniors. I can name only one student and recall but one outstanding incident. Professor Robinson said a page or so of the four or five pages of problems at the end of the chapter would be a reasonable task. The next morning Lamme asked me how many I had done: I gave an apologetic answer and reversed

the question. He quietly replied, "Well, I didn't have anything else to do so I worked them all."

Nearly four years later, shortly after Lamme had begun work with the Westinghouse company on May 1, 1889, I remembered that sentence when Mr. Schmid asked me, "Do you know that man Lamme? Can he figure?" And nearly forty years later, considerably more than half of which we worked in the same building—many years at adjacent desks, that sentence seems to reveal certain life characteristics—an interest in mathematical-mechanical problems, diligent effort at a self-imposed task far exceeding the normal expectation, a super-preparedness, a joy in accomplishment. His work as a student and as an engineer was not something apart from him, but it was a part of him.

As Chief Engineer of his Company Lamme interviewed many young men. To determine present aptitudes he ascertained what they liked to do as boys, believing no one would make a real engineer who had not shown certain early traits and likings.

Notes Tell of Early Life.

He left some notes in which he traces his own career in a sort of self-analysis. His earliest recollections concern the hunting of curious stones in a plowed field. He continued to gather Indian relics, such as stone axes and hammers and arrow heads. In his will he leaves to the University his treasured and rich collection. He enjoyed building blocks and mechanical toys. He liked to work with tools and made little water wheels which he placed in the stream. He tinkered around machinery whenever opportunity appeared. The real pleasure was in finding out how things worked and why they were made in certain ways. These interests in childhood matured into interest in design in later years. An early aptitude later proving of highest importance was a liking for elementary mathematics. The wise teacher in an old-fashioned country school let the scholars work out things in their own way. Lamme enjoyed mental arithmetic, particularly the relations of numbers. (In later life he patented

some magic square puzzles.) The multiplication table which we learned to 12, he learned to 25, then to 36. He developed curious and quick methods and a sense of proportion. While classmates in college thought mathematics "came easy" to him, he was studying more hours than they did. He endeavored to get a physical conception of mathematical ideas and relationships. Later in life he had an uncanny way of working out a result in his head before another man could get it on a slide rule. He used a slide rule for a short time but discarded it as the mechanical operation caused him to lose his quantitative sense and his facility for mental computation; furthermore, results were not retained mentally as they had been. Visualization and physical conception of principles and problems he employed constantly in his engineering work. Mathematical computation and analytical ability were closely associated. As a boy he directed his analytical ability to the characteristics of his schoolmates as well as to mathematical problems. A critical sense and persistency were other traits of youth which continued through life.

He determined, when a boy, to be an engineer, he set about to make an engineer of himself and he did.

Following his junior year, owing to the illness and death of his father, he spent a year at home on the farm near Springfield. After graduation from the Mechanical Engineering course he spent a half year at home, reading in spare hours Sylvanus Thompson's "Dynamo Electric Machinery," a compendium of historical and descriptive information. He sought the underlying principles and got a grasp on the idea of the magnetic circuit, then little understood. When he came to the Electric Company in Pittsburgh, he had a preparedness which was unsuspected. His evenings for many years he spent largely in study. He has said that often his quick and confident answer to some new question has been attributed to an intuitive insight which others do not possess instead of the hours of painstaking analytical study which had already given him the answer.

Opportunity is futile unless one is prepared to see it and

use it; Lamme was prepared. He graduated at the opportune moment when the electric current was establishing its usefulness for light and power and when the greatest problem was how to make bigger and better electrical machines; he was fortunate in the progressive leadership of George Westinghouse, who gave not only opportunity to design and construct, but incentive and impetus and inspiration; he was peculiarly fortunate in the early guidance and coöperation of Albert Schmid, a master in mechanical design.

Proved Equal to Opportunity.

Mr. Westinghouse had for two or three years been exploiting a new system, the alternating-current system. There were engineering criticism and commercial opposition from without and technical difficulties from within. The largest generators were less than two hundred horsepower; there were no commercial motors; there was no way to convert from alternating to direct current. The need and the opportunity were great. The design of new types of generators, of polyphase motors of various types, of synchronous converters, of an alternating-current railway system,—all these presented gigantic problems which Lamme met and solved. Present and proposed super-power systems and the utilization of power in industries and in railways employ the system on which he worked and most of the apparatus follows the designs which he inaugurated. He had many good assistants and much was done elsewhere, but Lamme was pioneer and leader, he originated new types and they have persisted. To him is due a far larger proportion of the prominent types of apparatus now in use than to any other designer. And his judgment was so good that he spent little effort on types which soon disappeared.

He never gave up. To him a defeat was a challenge. If trouble occurred, he at once sought a remedy—often he had already determined what to do if difficulties should arise. On one occasion there were serious troubles in an important installation. An official of the Company said, "Lamme, this

will be your monument or your tombstone." This did not perturb him. Now it is his monument.

Lamme was far more than an individual designer of particular machines, although he might well rest his reputation on the design of the single reduction railway motor, the machines exhibited at the World's Fair in Chicago, the generators which inaugurated hydro-electric power at Niagara, those for supplying power to the Elevated and Subway Systems in New York and the equipment which operates the New York, New Haven & Hartford Railroad. He says that his work was mostly analysis rather than design. He developed a system and method of simple rational design. He directed and taught others and during recent years his principal interest and activity and enthusiasm were directed to selecting and training men. He conducted a design class each year, he took active interest in *The Electric Journal* as chairman of its publication committee, suggesting topics and writers, critically reviewing manuscripts, and often summoning writers for conference, being particularly concerned in developing young engineers in clear thinking and expression. He wrote and spoke on engineering education. Years ago the electrical engineer was an isolated individual. Now invention and development and design are conducted by groups of men who work together. Lamme started as an individual but he developed an organization and left in his department a hundred men with the advantage of his knowledge, his experience, his methods and his inspiration.

His Genius Was Contagious.

Modest and retiring, he was a genial and inspiring companion to those who knew him. In later years, his reticence was somewhat overcome and he wrote papers and made some addresses. His clear and simple presentation, free from mathematical formula made his writings highly appreciated. He regarded mathematics as a tool and did not exhibit his tools when the work was done.

He never married, but made a home with his sisters. One

of them, Miss Bertha, graduated from Ohio State in engineering and became a competent designer under her brother's direction, but ceased engineering to become Mrs. Feicht. He was a broad reader, he liked travel, he was fond of the best music and was interested in archæology, he became an ardent and expert photographer and when he finally got an automobile he drove it nearly ten thousand miles in six months and knew all the roads within a hundred miles.

Habitual optimism and indomitable courage waged a long struggle against an incurable disease. With hopeful cheer he concealed his early fears and to the last his knowledge from his immediate family. Again he had prepared for emergency by deciding on plans for continuing his work and the provisions in his will. He died July 8th, 1924.

He Established Scholarships and Medals.

Even associates and friends little suspected how sincere was his interest in education and his Alma Mater until revealed by his will. It provides for a medal to be awarded by the American Institute of Electrical Engineers for meritorious achievement in the development of electrical apparatus or machinery; also for a medal to be awarded by the Society for the Promotion of Engineering Education for accomplishment in technical teaching or actual advancement in the art of technical training. It provides a medal for meritorious achievement in engineering or the mechanical arts by a graduate of one of the technical departments of the Ohio State University; also for two scholarships to be awarded to the most capable students in the mechanical and electrical engineering courses during their senior year. All these awards—incentives for advancing the profession he loved—are to be made annually. There is also provision for continuing the education of eleven French orphans, wards of his for several years past. He visited them in France about a year ago, he heard from them often and his last replies—individual and personal—he dictated just three weeks before his death.

"An Extraordinary Ordinary Man."

Summing it all up, after an acquaintance of many years and after talking with many who have worked with him and known him best, he was an extraordinary ordinary man. He had developed ordinary qualities to an extraordinary degree.

We all know the multiplication table, but he knew more of it and could use it better. He was an able mathematician but what he used most were mathematical reasoning and mental arithmetic. Most of us reason from effects back to causes, but he was wonderfully expert in getting directly back to the really fundamental starting point. He visualized and simplified his problems. He used short cut, direct methods in mathematics, in analysis, in action. He was unusually patient and persistent. When he had worked through to a conclusion, it became a conviction and he had the courage of his convictions.

Lamme was one of those whose greatness lay in the perfection and practice of common traits and homely virtues. The qualities which made him great, while especially important to the engineer, would contribute to success in many fields.

NEW MEMBERS.

District No. 1.

THE ENGINEERING INSTITUTE OF CANADA, 176 Mansfield Street, Montreal, Canada. Fraser S. Keith, General Secretary.

District No. 2.

HILL, ERL G., Assistant Professor of Metallurgy, University of Pittsburgh, Pittsburgh, Pa.

District No. 3.

VIRGINIA POLYTECHNIC INSTITUTE, Blacksburg, Va. Julian A. Burruss, President.

WASHINGTON AND LEE UNIVERSITY, Lexington, Va. Jas. Lewis Howe, Dean.

District No. 4.

GRISWOLD, RALPH SCOFIELD, Instructor in Electrical Engineering, Purdue University, LaFayette, Ind.

HEWES, JOHN WARR, Assistant Professor of Civil Engineering, Iowa State College, Ames, Iowa.

KELLER, JOHN FRANCIS, Steel Specialist, Engineering Extension, Purdue University, LaFayette, Ind.

District No. 5.

ANDREWS, CARL BOWERS, Professor of Engineering, University of Hawaii, Honolulu, T. H.

UNIVERSITY OF IDAHO, Moscow, Ida., Alfred H. Upham, President.

STATE COLLEGE OF WASHINGTON, Pullman, Wash., R. O. Holland, Pres.

ACKNOWLEDGMENT.

To the Members of the Society who have kindly contributed books to the National Southeastern University, Nanking, China:

Words cannot express our deep appreciation of your kind efforts in donating a large collection of the Society *Proceedings* and BULLETINS to this University. Your gifts fill a want which has been keenly felt after the disastrous fire that burned our Engineering Reference Library. Your generosity will leave a perpetual memory in China and in behalf of our College of Engineering I hereby tender you our most heartfelt thanks.

NATIONAL SOUTHEASTERN UNIVERSITY,
THOMSON E. MAO,
Dean.

October 30, 1924.

MEETING OF DIVISION OF DEANS AND ADMINISTRATIVE OFFICERS, S. P. E. E., UNIVERSITY OF MICHIGAN, JANUARY 25–26, 1924.*

The official register of the meeting gives the following officers of administration and deans in attendance, although a number of others took part in the sessions and the meetings of the deans.

Akeley, L. E., University of South Dakota
Anderson, Douglas, Tulane University
Anthony, G. C., Tufts College
Ayer, F. E., Municipal University of Akron
Bishop, F. L., University of Pittsburgh
Bissell, G. W., Michigan Agricultural College
Boardman, H. S., University of Maine
Bolton, F. C., A. & M College of Texas
Braune, G. M., University of North Carolina
Burton, M. L., University of Michigan
Carman, G. N., Lewis Institute
Clutz, F. H., Gettysburg College
Cooley, M. E., University of Michigan
Crouch, C. H., University of New Hampshire
Davis, G. J., University of Alabama
Dunlap, J. H., American Society of Civil Engineers
Ell, Carl S., Northeastern University
Faig, J. T., Ohio Mechanics Institute
Felgar, J. H., University of Oklahoma
Ferguson, O. J., University of Nebraska
Frazer, John, University of Pennsylvania
Fussell, L., Swarthmore College

* The lateness of this report is due to the fact that the chairman of the meeting was unable, because of health and other engagements, to complete the editing until this time. He begs the indulgence of the membership of the Society.—ARTHUR M. GREENE, JR.

Greene, A. M., Jr., Princeton University
Hayford, J. F., Northwestern University
Hitchcock, E. A., The Ohio State University
Holden, C. A., Dartmouth College
Howe, C. S., Case School of Applied Science
Hughes, H. J., Harvard University
Hollis, Ira N., Worcester Polytechnic Institute
Jones, C. R., University of West Virginia
Ketchum, M. S. University of Illinois
Kenerson, W. H., Brown University
Lapham, J. S., University of Virginia
Leland, O. M., University of Minnesota
Luther, H. B., University of Cincinnati
Lewis, E. H., Lewis Institute
McCaustland, E. J., University of Missouri
McNair, F. W., Michigan College of Mines
McCourt, W. E., Washington University
Marston, Anson, Iowa State College
Mitchell, G. H., University of Toronto
Mitchell, Louis, Syracuse University
Mott, W. E., Carnegie Institute of Technology
Nash, P. C., Antioch College
Nies, J. D., Lewis Institute
Norris, E. B., Montana State College
Pegram, G. B., Columbia University
Pender, Harold, University of Pennsylvania
Pinney, J. C., Marquette University
Potter, A. A., Purdue University
Pritchard, S. R., Virginia Polytechnic Institute
Prentice, D. B., Lafayette College
Raymond, H. M., Armour Institute of Technology
Raymond, W. G., State University of Iowa
Richards, C. R., Lehigh University
Rockwell, E. H., Rutgers College
Robbins, Dr., University of Michigan
Rogers, F. A., Lewis Institute

Roys, F. W., Worcester Polytechnic Institute
Sackett, R. L., Pennsylvania State College
Slichter, W. I., Columbia University
Scott, C. F., Yale University
Snow, C. H., New York University
Stowe, A. M., Toledo University
Turneaure, F. E., University of Wisconsin
Votey, J. W., University of Vermont
Wagner, F. C., Rose Polytechnic Institute
Walker, P. F., University of Kansas
Warren, C. H., Yale University
Wickenden, W. E., Director of Investigations
Williams, G. S., University of Michigan
Whitehead, J. B., Johns Hopkins University

MEETING OF JANUARY 25, 1924.

The meeting was called to order at 2:00 P.M. by M. E. Cooley, Dean of the Schools of Engineering and Architecture, University of Michigan.

M. E. Cooley: This idea of a division of deans goes back about twenty-five or thirty years, when four teachers of engineering, Carpenter of Cornell, Spangler of Pennsylvania, Hollis of Worcester, and myself met in a restaurant on Broadway in New York. We had dinner and the object of the dinner was to discover if there were ways and means by which colleges could get together in coöperation and the principle question was the keeping of our respective institutions along such lines so that there would be no duplication in institutions for definite work. That question was discussed at some length and we reached the conclusion that it was impractical and that each college would prefer to go its own way. I have always believed that engineering colleges could get together and should exert themselves in planning curriculum and provide equipment for engineering students so as to avoid duplication. Some three years ago when the Society met at Yale I talked with President Burton who had just come into

the presidency here and discussed an association of deans. Whether it would not be advisable and possible for engineering deans to get together as well as teachers of liberal arts. He approved the plan and authorized me to extend an invitation to you at Yale. I called a meeting of deans and presidents one evening down at the shore and it was enthusiastically agreed that such an organization would be feasible and a committee of deans were appointed to carry it out. There were difficulties in the way. I was delegated to arrange a committee but many I asked would not serve. The matter rested until the following spring and Dean Raymond wrote me a letter asking me to meet with about 15 other deans in Chicago. We met and spent a day discussing things that we might do. The group of deans was from the Mid-West institutions. It was a very satisfactory meeting.

A few months afterwards the Society met at Urbana and there you remember a Division of Deans was authorized and Dean Raymond was chairman of it last year. Then we came together at Ithaca; the invitation of President Burton was extended to you again and you accepted. We have come together for a purpose and if it can be realized it will be of great promise to the engineering profession. During the past two years or more I have had opportunity to get in contact with those outside of teaching of engineering. As I see it the profession is made up of individuals and there has never been any coöperation in the engineering profession that I know of. As long as engineers act as individuals the profession will not make progress. The time has come in our life when it seems to me that the engineer has a real duty to perform, a real duty to civilization and one he cannot perform unless the profession as a whole acts. That is one of the things I am hoping will come out of this division of deans. You have come together not to discuss practical things that I have referred to. What can the engineer do outside of his profession as a result of his training and skill as an engineer?

Gentlemen, you come together here and I am not sure

that the result of this meeting is going to be tangible when we have finished. It is more to become acquainted and that is the first step if we are to accomplish anything. We must know each other and have a personal point of view. I am thinking also as a result of this meeting a good many ideas will be put forward to which we will not subscribe but we must take them back home with us and perhaps when we come together again we will think more of them. Place the engineering profession at a point in the lives of our country which will enable it to do more for the people of the country than we are able to do at this time. I have great faith that if we come together we can exert a force which will be felt and which will make history.

I welcome you in the name of President Burton, in the name of the University of Michigan, and in the name of the State. We are glad to have you here. Do as you would in your own homes.

Arthur M. Greene, Jr.: Dean Cooley: We are very much pleased with these words of greeting and we will all avail ourselves of the privileges which you have offered. We do appreciate the kindness and cordiality of the University of Michigan, its Board of Regents, and the members of the Faculty of the Engineering Department.

I wish to call attention to the fact that your committee has placed on the program those topics which to them seemed feasible for general discussion among those in charge of engineering schools in this country. Although this organization was planned by one of the presidents of the S. P. E. E., this Division is for engineering education of the country regardless of that Society. We are also glad to have the representative of one of our Canadian schools. We only wish that others could be here. We want all here to enter into this meeting, to enter into the discussions because only by interchange of ideas can we hope to get anywhere.

Dean Greene appointed the following men members of the

Committee on Resolutions. Anderson of Tulane, Whitehead of Johns Hopkins, and Mitchell of Toronto, Chairman.

TOPIC—LENGTH AND CONTENT OF THE CURRICULUM.

The Harvard Plan.

Dean H. J. Hughes.

After the Lawrence Scientific School was discontinued and the Graduate Schools of Applied Science were established, admission was open only to graduates of colleges or other technical schools. When we returned from Tech and reorganization was secured we put the school back again on the undergraduate as well as the graduate basis. We have a four-year program. We have a four-year course in Civil Engineering and we have been running a four-year course in Metallurgy but we do very little registration in other schools. They decided to put Sanitary, Mechanical and Metallurgy on graduate bases. Then we have a five year program combining engineering and business administration. We are coöperating with Harvard College in the first year and with Harvard Business School in the last year. We have not been able to make it without duplication. The coöperative plan has not been successful. The faculty has decided that we should discontinue this alternative plan and make students take summer work. Further details of the plans of the Harvard Engineering School is given in the mimeographed sheets which will be distributed.

Harvard University,

The Harvard Engineering School.

Four-year programs in mechanical, electrical, electric communication, and civil engineering; mining; industrial chemistry; and sanitary chemistry.

Degree: Bachelor of Science with designation of department of study.

Five-year programs combining engineering (mechanical, electrical, civil, or mining) and business administration.

Degree: S.B. in Engineering and Business Administration with designation of department of study.

Post-Graduate study and Research.

Degrees: S.M. with designation of department; Mining Engineer; Metallurgical Engineer; Doctor of Science.

Admission to First-year (Freshman) Class for 4-yr. and 5-yr. Programs.

(1) Old Plan—Examination only.
Must pass in 15 units of College Entrance Examination Board.

(2) New Plan—School record and examination.
(*a*) Evidence of an approved school course satisfactorily completed, and
(*b*) Must show in four comprehensive examinations (English being one) that scholarship is of satisfactory quality.

(3) In 1923–24, for the first time—The satisfactory completion of an approved school course (as in New Plan), and a place in the *highest seventh* of the graduating class. This plan is on trial.

Admission to Advanced Standing in 4-yr. and 5-yr. Programs.

One or more years of study in a college or scientific school of good standing which has been completed creditably, with no failures, deficiencies or unsatisfactory grades; in certain cases at least two years is required as a minimum. Standing depends upon previous training.

Graduation from another college or university of good standing.

Admission to Post-Graduate Study.

A degree from a scientific school, college or university of good standing, and preparation equivalent to the requirements for a bachelor's degree in this School.

Four-Year Programs.

The studies of the four-year programs are so planned that boys entering the School directly from high schools and academies, and whose time and resources are limited, can in four years acquire a foundation for the profession of engineering and for the engineering industries.

These programmes are designed not to stand by themselves, but as definitely linked up with the opportunities for general study in Harvard College. Studies which may usually be completed in College are placed in the first two years of the engineering programmes; these are chiefly English, mathematics, and science. The work of the last two years is mainly professional.

Although the Engineering School is organized under its own faculty, it has close relations with the Faculty of Arts and Sciences, which includes Harvard College and the Graduate School of Arts and Sciences. Each faculty has a limited representation in the other faculty. The six hundred courses offered by the Faculty of Arts and Sciences are open to engineering students as electives. At least half of the studies required in engineering programmes are courses given by the other faculty.

The requirements for admission to the Engineering School and to the College are the same and are administered by the same committee. A student who enters the Engineering School first, and later finds himself unsuited to a scientific career, or who wishes to take more general studies than the engineering programs offer, may transfer to the College at the end of one or two years and count work done in the Engineering School toward a degree in the College.

Similarly a student in the College may include, as part of the work for a College degree, those subjects which are prescribed in the first two years of any of the engineering programs. Four years is the usual time spent in getting the College degree; but the work can be, and often is, done in

three years. High-grade students can win both a College degree and the Engineering degree in five years.

A graduate of a high-grade college should be able to fulfill the requirements for an engineering degree in two years after entering the School.

The programmes are the same for one year; most of them for two years, or with only minor changes. And the programmes in mechanical, electrical and civil engineering are so nearly alike for three years that students in these fields (the majority of our students) do not have to make their final decision as to programme till the end of the third year.

Instruction in the professional subjects is given only by men of faculty rank. The classes or sections are all small; it is expected that they will be kept so.

The thesis for undergraduates is not required, but both preliminary and final reports are required as part of much of the laboratory instruction.

A course in accounting, and a survey course in business administration are required in the engineering programs.

The electives in general studies are a free choice. English is a prescribed study.

Industrial Coöperation.

Industrial coöperative work was established three years ago for third-year students in mechanical, electrical and civil engineering. This work begins at the end of the sophomore year and ends at the beginning of the senior year. By using two summer vacations and the junior year, and by alternating studies and outside work in bi-monthly periods, at least six months of industrial experience was provided. The arrangement of tabular views, that would synchronize with Harvard College in the earlier years, and with the Business School in the later years, has proved to be both difficult and expensive. Beginning with 1924–25, industrial work is to be done only in the vacations. The rearrangement will, it is thought, provide many of the advantages of the alternating plan, and permit students to maintain continuous contact with the Uni-

versity during the academic year, which the students as well as their parents value.

The Five-year Programs in Engineering and Business.

Recognizing the importance of business training for engineers, the faculties of the Engineering School, and of the Graduate School of Business Administration, three years ago organized five-year combined programs which include; (*a*) on the engineering side all the scientific and general subjects of a four-year program; and (*b*) on the business side, a course of study in industrial management. The first three years of these five-year programs are the same as in the corresponding four-year programs. The fourth and fifth years are each made up of two courses in engineering and three courses in business; the four engineering courses being the fourth year enginering studies of the four-year program. Each faculty gives its own special subjects; the work as a whole is under a joint committee representing the two Schools.

Graduate Study and Research.

Graduate students are expected to plan their own programmes. Any well-defined plan of study is likely to be approved if it is made up essentially of graduate work and research. The plan may properly include a limited amount of work in a scientific department of the Faculty of Arts and Sciences. If a graduate program lies mainly in one department, a full year's work completed with high credit leads to a Master's degree with designation of field of study. A diversified program leads to the degree of Master of Science in Engineering (without designation of field). A year's work is four full courses.

The degree of Doctor of Science is given only for high attainment in a special field of learning, manifest by a thesis giving evidence of independent research of a high order, and by special examinations covering the entire field in which the candidate is specializing, as well as in the particular subject

of research. Two years after taking a bachelor's degree is the *minimum* time requirement; but a longer time is usually required. At least one year of graduate study must be done in residence in the School.

Some of the graduate work is organized class room instruction; but much of it is research under individual professors, or departmental committees. The School offers an extensive and varied group of graduate courses and subjects for research; and its laboratories though not large are well equipped.

Discussion.

W. H. Kenerson: Does any college give the degree of B.S. at end of five years.

H. J. Hughes: We give bachelor degree only at the end of five years. No degree at the end of four years.

A. M. Greene: If a man elects in his fifth year courses sufficient to graduate in Harvard College, might he get a degree of B.S. in Harvard College and then the degree from the Engineering School?

Dean Hughes: If a man enters for five years and then selects his subject so that at the end of three years he fulfills 17 credits in Harvard College can he not graduate? No. There are only about two years of work that can be carried. He can go back to College at the end of two years, then complete requirements for degree in the College.

Dean Raymond: We have a joint course with the College of Liberal Arts, a five-year course. Three years in the College then after one year with us that college gives a B.S. degree and at the end of five years we give the degree in engineering.

Dean Hughes: The Faculty of the Graduate School of Business Administration gives courses to those men in engineering school who are registered in the five-year program. The ordinary undergraduate in the Engineering School can not take these courses.

Question: Are they given by men who have engineering background?

Dean Hughes: Courses in industrial management are given by man who was head for a time of the department of steam engineering at Wisconsin. Transportation given by a man who was connected for many years with railway service. Accounting courses given by a man who is a certified accountant. Some of the other courses are not given by men with engineering background but with good business background. I might add that we have required physical training for Freshmen. The Business School was started some ten or fifteen years ago with Gay as Dean. It was organized at one time and the business courses were given at Harvard College by the Department of Economics. The Business School is now entirely an independent school with about 600 students. For admission you must be a graduate of a technical school or college. No undergraduate may enter. The course of study is two years in length and they offer eight or nine programs. I do not think I can give you all of them. Each one contains about five courses per year. Every student takes accounting. Thy all take labor problems and business policy. One program is to train men especially for accounting. Another transportation. Another banking. Industrial management, etc. That is, a two years course of study after graduation from college or another school. For the men who are not engineers one of their difficulties is in courses which ought to have engineering background. They make an effort to supply the background. Each student is expected to study in some industrial work. They keep up close contact with industry. They spend a great deal of time in collecting cases and problems for students. In addition to the regular faculty some of the courses have business men from all over the country to give lectures. It is the highest priced school in the University. They charge students what the instruction costs —$400 per year. There is a loan fund for students who need it. Tuition in other departments is $250 per year.

President Faig: Does that cover all expenses?

Dean Hughes: Yes. It covers all expenses but we are now raising an endowment to build new buildings.

The Michigan Plan.

Dean M. E. Cooley.

The University of Michigan has no five-year curriculum. I suppose five years has been given to the study be we have never been able to agree. I think we are very nearly agreeing, however, and the delay at the present time is to avail ourselves of the results of the investigation to be made under the direction of the Board of Investigation and Coördination. I think our Faculty feels that it should have the benefit of all the facts before they finally determine upon a five-year course.

While we have no five-year curriculum, we have five-year courses. Here on the campus we have four years in the Engineering College and then study for one year for a master's degree. We have students at work for the professional degree, B.S., M.S., both in engineering and the professional degree of C.E., M.E., or E.E., or whatever it may be.

We have five year courses in coöperation with our College of Detroit. This was recently established. Our affiliation was approved by the Board of Regents this morning. I think you would be interested in knowing something about this joint course. It probably indicates a new direction. The College of the City of Detroit sends its students to us at the end of three years and those students take two years here. At the City of Detroit College they confer upon graduates the degree of A.B. These students receive the degree of B.S. from Michigan at the end of five years.

The tentative program for the three years of work done in the College of the City of Detroit before entrance to Michigan is given in the table below:

A Tentative Three-year Preëngineering Program for Combined Five-year Course with College of City of Detroit.

First Year.

Semester I.		*Semester II.*	
Modern Language	4 hours.	Modern Language	4 hours.
Rhetoric 1 or 1E	3 or 4 hours.	Rhetoric 2	3 hours.
Mathematics 4 (Algebra-Analytic Geom.)	4 hours.	Mathematics 5 (Analytic Geometry)	4 hours.
Drawing 1 (Mechanical Drawing)	3 hours.	Chemistry 3 (General Chemistry)	4 hours.
Shop 2 (Metal work)	2 hours.		
	16 or 17 hours.		15 hours.

Second Year.

Semester I.		*Semester II.*	
Modern Language	4 hours.	Modern Language	4 hours
Mathematics 6 (Calculus)	5 hours.	Mathematics 7 (Calculus and Diff. Eq.)	5 hours.
Chemistry 4 (Qualitative Analysis)	4 hours.	Physics 1E	5 hours.
Descriptive Geometry	3 hours.	Surveying	2 hours.
	16 hours.		16 hours.

Third Year.

Semester I.		*Semester II.*	
Physics 2E	5 hours.	Engineering Mechanics	4 hours.
Economics 1	3 hours.	Chemical Engineering	3 hours.
English	3 hours.	Economics 2, 3, 4, or 5	3 hours.
Social Science Elective	3 hours.	English	3 hours.
Other Elective	2 or 3 hours.	Other Elective	3 hours
	16 or 17 hours.		16 hours.

Division of Hours.

English	12 or 13 hours.	Surveying	2 hours.
Modern Language	16 hours.	Drawing	6 hours.
Mathematics	18 hours.	Shop	2 hours.
Physics	10 hours.	Economics or Social Science	9 hours.
Chemistry	8 hours.	Engineering Mechanics	4 hours.
General Electives	5 or 6 hours.		
Chemical Engineering	3 hours.		
		Total	95 or 97 hours.

We have found this affiliation of colleges extremely satisfactory. We are disposed to encourage similar affiliations with other colleges. It possibly may be the solution of the great coördination which now exists in our College. I have advocated closer relations of our colleges throughout the state with the University. It would strengthen the smaller colleges not only in faculty but also in equipment and would build up a system for the state which would be of great advantage to the state.

Dean Bates of the Law School informed me that the Regents have adopted a three-year pre-law requirement for admission to the Law School. We have a six-year course in medicine. Expressing my personal views I am not certain that members of the faculty will agree with me to our present four-year course containing all general subjects, while the same time should be given to professional subjects. There is no necessity so far as the future of the engineer is concerned to give more time to professional subjects. What the engineer needs is very much greater amount of time devoted to general studies. I think many persons will agree with me on the requirements that additional time should be given to general studies. They will not agree that we give more time to humanities. I mean history, etc. I think the engineer should take the place in the world which he is justified in taking in the development of civilization. He has done everything for it but done nothing to prevent its decay. He should have his mind trained here and before he comes to college to appreciate the things which he as an engineer should do for the protection of our civilization and which he does not do now.

The Columbia Plan.

Professor W. I. Slichter.

Professor W. I. Slitchter of Columbia University reported for Dean George B. Pegram and gave a statement regarding the Columbia plan of engineering education. The work at Columbia is based on three years of preëngineering work,

divided among Mathematics, Language, Science and Economics. The division of this work is given in the table below. The preparation for this course is that demanded by Columbia College, the undergraduate department of Columbia University.

COLUMBIA UNIVERSITY, JANUARY, 1924—COURSE IN COLUMBIA COLLEGE PREPARATORY TO ENGINEERING.

Subjects.	Freshman Year.	Sophomore Year.	Junior Year.
English	20		
Con. Civ.	30		
Mod. Lang.	20		
Math.	20	17	
Phy. Ed.	10	6	
Chem.		32	15
Drafting		20	
Economics			16
Physics			37
Elective		25	32

Tabulation in Per Cent. of Total Working Time of Student of Time Allotted to the Several Subjects, Including Class Room, Laboratory and Study. (Study times in the main from estimates of whole student body.)

Subjects.	Min. Eng.			Elec. Eng.			Chem. Eng.		
	First Year.	Second Year.	Third Year.	First Year.	Second Year.	Third Year.	First Year.	Second Year.	Third Year.
Chemistry	13.5						43	20	
Physics	13.0			30	10	14	15		
Mechanics	15			15			15.5		
Chem. Eng.				14			21.5	13	48
Civil Eng.		25	8	4	12			12	
Elec. Eng.	7.5		21	16	47	67		21	
Mech. Eng.	10	10	8	17	31	19	5	11	8
Ind. Eng.									
Metallurgy		3	13	4					
Drafting	6								
Min. Eng.		40	50						
Mineralogy	19.5	10							
Astronomy									
Geology	15.5	12							
Electives								23	31

Following the three years' preparation, three years' work in engineering is taken in accordance with the table below in which percentages of time spent in the various subjects are given.

Professor Slichter stated that at present there is a discussion among the Faculty of the University regarding changes in this plan of study.

The Missouri Plan.

Dean E. J. McCaustland.

Length and Content of Engineering Curricula.

In 1911 the training of engineers in the University of Missouri was placed upon a professional basis by the organization of a School of Engineering in which the professional curricula were made three years in length and were preceded by two years of college work or sixty hours' credit in the College of Arts and Science. The freshman and sophomore requirements in that College were fixed, and the faculty of Engineering specified that certain courses in science be included within the sixty hours, so that the entire two years were devoted to required subjects. The distribution of this preëngineering training was as follows:

Humanistic subjects, including history, English, ancient and modern languages ..... 20 hours.
Sciences, including chemistry, a biological science, physics and mathematics ..... 40 hours.

The planning of the 3-year curricula in the Professional School resulted in the inclusion of subjects almost entirely drawn from scientific and professional fields, with the strictly professional type very largely predominating. The distribution within the departments is shown in Table I, in which the curricula in Civil, Electrical and Mechanical Engineering are taken as typical of the application of the principles inspiring the Faculty.

TABLE I.

Showing the Distribution and Character of Subjects in Professional Curricula Following 60 Hours' Credit in Arts and Science.

A normal semester schedule was 15 hours' credit.

	C.E.	E.E.	M.E.
General, Total Hrs.	1	1	1
Introd. to Eng.	1	1	1
Scientific, Total Hrs.	15	13	8
Geology	3		
Physics		5	
Mech. of Eng.	8	8	8
Astronomy	4		
Professional, Total Hrs.	74	76	81
Civil Eng.	47	2	5
Elective	16	17	13
Elec. Eng.		34	8
Mech. Eng.	3	8	40
Drawing	8	7	7
Shop		8	8
TOTAL HOURS FOR 3 YEARS	90	90	90

Table II shows the distribution of the subject matter for the entire five years of training.

TABLE II.

	C.E.	E.E.	M.E.
General, Total Hrs.	21	21	21
From Arts and Science	20	20	20
From Professional Curric.	1	1	1
Scientific, Total Hrs.	55	53	48
From Arts and Science	40	40	40
From Professional Curric.	15	13	8
Professional, Total Hrs.	74	76	81
TOTAL HOURS FOR 5 YEARS	150	150	150

The occasion for establishing the professional school was the development of a conviction on the part of the faculty that there was need of broader education for the engineer and

that the curricula previously established in the University were not only narrow professionally—*i.e.*, confined to one department—but that the fundamental scientific training and the opportunities to get an insight into the humanistics were too restricted. Table III shows the distribution of the work before the organization of the professional school in the fields of general training, scientific study and professional work.

TABLE III.

Distribution of Work Leading to Professional Degrees Prior to 1911.

	C.E.	E.E.	M.E.
General, Total Hrs.	16	15	10
English	5	5	5
Introd. to Eng.	1	1	1
Economics	2	4	2
Elective unrestricted	8	5	2
Scientific, Total Hrs.	45	46	41
Mathematics	18	18	18
Physics	10	15	10
Chemistry	5	5	5
Astronomy	4		
Mech. of Eng.	8	8	8
Professional, Total Hrs.	89	89	99
Civil Engineering	77	2	5
Elec. Engineering		64	7
Mech. Engineering	3	8	72
Drawing	8	7	7
Shop	1	8	8
TOTAL	150	150	150

The establishment of the Professional School resulted in some falling off in student attendance. This may have been due to objections to the longer course, but there is evidence that the main objection was directed to the restriction preventing the student from entering directly into an engineering school. The protest against entering the College of Arts and Science for a period of two years was very marked, and the desire to be recognized as candidates for engineering degrees resulted in the organization of a preëngineering group

within the College of Arts and Science. The Professional School was short lived; while the faculty would probably have continued to maintain the professional plan, it was, through certain influences entirely unrelated to educational efficiency, practically forced to abandon the professional idea and to return to the previous plan of offering a bachelor's degree at the end of the fourth year while still maintaining the five-year curricula. The bachelor's degree adopted was bachelor of science in engineering instead of bachelor of science in civil, electrical or mechanical engineering. The faculty attempted, however, to retain, so far as possible, all the good points in the professional plan and the present organization of the curricula is the result of this attempt.

TABLE IV.

Shows Distribution of Work in the Departments of Chemical, Civil, Electrical and Mechanical Engineering, 1923–24. Five-Year Curricula Leading to the Professional Degrees.

	Ch.E.	C.E.	E.E.	M.E.
General, Total Hrs.	27	33	34	36
Citizenship	10	10	10	10
Economics	5	5	5	5
Elective	7	10	14	13
Business Law	3	3	3	3
Technical Writing	2	2	2	2
Accounting		3		3
Scientific, Total Hrs.	46	46	47	43
Mathematics	20	20	20	20
Physics	10	10	14	10
Gen. Chemistry	8	5	5	5
Mech. of Eng.	8	8	8	8
Geology		3		
Professional, Total Hrs.	77	71	69	71
Chem. Engineering	42	0	0	0
Civil Engineering	11	47	11	11
Elec. Engineering	8	8	38	8
Mech. Engineering	7	7	11	39
Drawing	5	5	5	5
Shop	4	4	4	8
TOTAL	150	150	150	150

Therefore, to present the case briefly, the essential features of the Missouri plan are as follows:

First. Curricula covering five years and leading respectively to the professional degrees of civil engineer, mechanical engineer, electrical engineer, etc., with provision for granting the degree of bachelor of science in engineering on the satisfactory completion of the first four years of any curriculum. (See Table VIII for complete outline of curricula and Table IV for distribution of subject matter between general, scientific and professional fields in the five-year curricula. Table V shows the same distribution for the four-year curricula.)

TABLE V.

Distribution of Work in Departments of Chemical, Civil, Electrical and Mechanical Engineering. Four-Year Curricula Leading to the Degree of Bachelor of Science in Engineering, 1923–1924.

	Ch.E.	C.E.	E.E.	M.E.
General, Total Hrs.	21	21	26	24
Citizenship	10	10	10	10
Economics	5	5	5	5
Elective	4	4	9	7
Tech. Writing	2	2	2	2
Scientific, Total Hrs.	46	46	43	43
Mathematics	20	20	20	20
Physics	10	10	10	10
Gen. Chemistry	8	5	5	5
Mech. of Engineering	8	8	8	8
Geology		3		
Professional, Total Hrs.	53	53	51	53
Chem. Engineering	18			
Civil Engineering	11	29	11	11
Elec. Engineering	8	8	20	8
Mech. Engineering	7	7	11	21
Drawing	5	5	5	5
Shop	4	4	4	8
TOTAL FOR 4 YEARS	120	120	120	120

Second. The content of the curricula is chosen with reference to the principle of offering a thorough training in the fundamental sciences, affording a definite introduction to the field of the humanities and still maintaining a sufficient

TABLE VI.

Distribution of Work in Curricula Showing Proportion of General, Scientific and Professional Work Common to All. Also Distribution of Professional Subjects in Curricula, 1923–1924.

General		21
Citizenship and English	12	
Economics	5	
Elective	4	
Scientific		43
Mathematics	20	
Physics	10	
Chemistry	5	
Mechanics of Engineering	8	
Professional		35
C.E. Surveying	3	
Materials of Construction	3	
Hydraulics	3	
Graphic Statics	2	
M.E. Heat Machinery A	3	
Drawing and Machine Design	9	
Shop	4	
E.E. Electrical Machinery	8	
		99

	Ch.E.	C.E.	E.E.	M.E.
Chemical Engineering	21			
Civil Engineering		18		
Electrical Engineering			12	
Mechanical Engineering			4	14
Shop				4
Geology		3		
Elective			5	3
TOTAL, PROFESSIONAL	21	21	21	21
TOTAL FOR 4 YEARS	120	120	120	120
For Fifth Year				
General	8	12	8	12
Professional	22	18	22	18
TOTAL	30	30	30	30
TOTAL FOR 5 YEARS	150	150	150	150

amount of strictly professional work to prepare the graduate to take his place in the industries. (See Tables IV and V.)

Third. Professional narrowness is avoided by including identical courses in all curricula to the extent of about three and one third years' work. The fourth and fifth years are about 60 per cent. professional in the particular department. (See Table VI.)

At the present time six separate five-year curricula are offered leading respectively to the degrees of agricultural engineer, chemical engineer, civil engineer, electrical engineer, industrial engineer and mechanical engineer. The degree of bachelor of science in engineering will be granted upon the completion of the first four years of any one of these curricula.

The following figures show in percentages the distribution of the work among humanistic, scientific and professional subjects; the total professional credits are segregated to show those required of all students regardless of curriculum and those required of students in the particular curriculum pursued for his degree. This segregation gives information regarding the breadth or otherwise of the professional training.

First, in the present five-year curricula the distribution is approximately as follows:

Humanistic		24 per cent.
Scientific		29 per cent.
Professional, required by all	23 per cent.	
Professional, restricted to one field	24 per cent.	47 per cent.
		100 per cent.

Second, the five-year curricula laid out when the school was organized on a professional basis, showed the following proportions:

Humanistic		14 per cent.
Scientific		35 per cent.
Professional, required by all	8 per cent.	
Professional, restricted to one field	43 per cent.	51 per cent.
		100 per cent.

Third, for the first four years of the present curricula the work is distributed approximately as follows:

Humanistic		18 per cent.
Specific		35 per cent.
Professional, required by all	29 per cent.	
Professional, restricted to one field	18 per cent.	47 per cent.
		100 per cent.

Fourth, in order to present a comparison with the above, the following shows the distribution of subjects in the curricula in 1909 prior to the establishment of the professional school:

Four-Year Course Leading to the Degree of Bachelor of Science in Civil, Electrical or Mechanical Engineering.

Humanistic		12 per cent.
Specific		37 per cent.
Professional, required by all	10 per cent.	
Professional, restricted to one field	41 per cent.	51 per cent.
		100 per cent.

Five-Year Course Leading to the Professional Degrees.

Humanistic		9 per cent.
Specific		31 per cent.
Professional, required by all	9 per cent.	
Professional, restricted to one field	51 per cent.	60 per cent.
		100 per cent.

The above statements of percentages are grouped in Table VII to more easily make comparisons.

TABLE VII.

Curricula.	Humanistic.	Scientific.	Professional.		
			Req'd of All.	Restricted to One Field.	Total.
Present Curricula, 5 yr.	24	29	23	24	47
Professional School, 5 yr.	14	35	8	43	51
Curricula, 1909, 5 yr.	9	31	9	51	60
Present Curricula, 4 yr.	18	35	29	18	47
Curricula, 1909, 4 yr.	12	37	10	41	51

Curricula in chemical engineering, civil engineering, electrical engineering and mechanical engineering are outlined in Table VIII and show the distribution and extent of particular subjects. (Agricultural and industrial curricula are omitted on account of lack of space.) The name of a course does not always closely identify its content; general physics, heat machinery A, graphic statics, materials of construction and drawing II may be presented in various guises. However, the inclusion or absence of specific subjects will give some idea of the principles guiding the faculty adopting such curricula.

In all curricula the student is required to show a minimum of two months' practical experience in engineering work or work allied to engineering as a prerequisite to the bachelor's degree; also four months of similar experience as a prerequisite to the professional degree.

TABLE VIII.

Curricula in Engineering, 1923–1924.

Leading to the degree of Bachelor of Science in Engineering at the end of four years and the professional degree at the end of the fifth year.

First Year.

Same in All Curricula.

Freshmen and Sophomores in all courses required to take Military Science and Physical Education, four clock hours per week.

	Term.		
	First.		Second.
Citizenship and English Composition	5		5
Trig. and Alg	5		
Anal. Geom			5
Gen. Inorg. Chem	5	or	5
Drawing I	3	or	3
Woodwork	2	or	2
	15		15

Chemical Engineering.

Second Year.			*Third Year.*		
Subject.	Term.		Subject.	Term.	
	First.	Second.		First.	Second.
Calculus	5	5	Mech. of Eng.	4	4
Gen. Physics	5	5	Elec. Mach.	4	4
Gen. Inorg. Chem.	3		Organic Chem.	5	
Qual. Analysis		3	Quan. Analysis		5
Metal Work	2 or	2	Mtls. of Const.	3	
Drawing II	2 or	2	Elem. Surveying		3
	15	15		16	16
Fourth Year.			*Fifth Year.*		
Phys. Chemistry	5		Industrial Chem.	3	3
Hydraulics	3		Chem. Tech.	2	2
Mach. Design A.		4	Quan. Analysis	5	
Ht. Mach. A.	3		Organic Chem.	3	
Graphic Statics	2		Business Law		3
Gen. Economics		5	Thesis	2	2
Tech. Writing		2	Elective		5
Elective	1	3			
	14	14		15	15

The content and educational purpose of engineering curricula are questions much discussed; but these are not scientific problems to which there can be but one answer; the conclusion reached by an individual faculty member is likely to be merely a personal opinion based on temperament and personal experience. For this reason educational progress is slow and everywhere curricula are in a state of unstable equilibrium. The one outstanding fact appears to be that neither length nor content of curricula are in any degree comparable in importance to the manner in which the student is related to his curriculum *through his teachers.* The following points appear to be fundamental in the training of any engineer: Whatever his natural aptitude it can only be developed and trained to the utmost *by a good teacher.* Whatever his intel-

Civil Engineering.

Second Year.			*Third Year.*		
Subject.	Term.		Subject.	Term.	
	First.	Second.		First.	Second.
Calculus	5	5	Mech. of Eng.	4	4
Gen. Physics	5	5	Elec. Mach.	4	4
Elem. Surveying	3 or	3	R. R. Surveying		3
Mats. of Const.	3 or	3	Heat Mach. A.	3 or	3
Drawing II	2 or	2	Graph. Statics.	2 or	2
Metal Work	2 or	2	Gen. Economics.	5 or	5
			Rds. and Pavements	2	
	15	15		15	16
Fourth Year.			*Fifth Year.*		
Hydraulics	3		R. R. Surveying	3	
Higher Sur.	4		Bridge Design	3	
Stresses	3		Water Power		3
Struct. Design		2	Concrete Struct.		3
San. Eng.		2	Business Law		3
Mas. Structures	2		Accounting	3	
Phys. Geology		3	Elective	6	6
Mach. Design A.		4			
Tech. Writing		2			
Elective	2	2			
	14	15		15	15

lectual endowment it must be directed by his teacher so that it may finally function clearly, logically and accurately. Whatever his training it must be methodical, rigorous and continuously more disciplinary and self-imposed, and to make this possible *the teacher* is of first importance. To merely pursue a wide range of subjects under narrow and self-centered specialists who have little or no interest in the student or in problems of teaching will not of itself insure either thoroughness or breadth of education.

The subject matter of an engineering curriculum should be arranged so that a student may recognize definite accomplishment at the end of each period. He should first be introduced

to that common body of knowledge which has always served to hold men and women in intellectual sympathy and understanding, namely, languages, civics, history and mathematics. Training to develop the expert should follow later in the course, and if curricula are organized in this manner the student may withdraw at the end of one or two years with a training that is definitely calculated to promote better citizenship, whatever the final vocation. If the student has a keen interest in the work and his intellectual capacity and aptitudes will justify, he will probably continue to the end of a four-year period.

Electrical Engineering.

Second Year.			*Third Year.*		
Subject.	Term.		Subject.	Term.	
	First.	Second.		First.	Second.
Calculus	5	5	Gen. Econ.	5	
Gen. Phys.	5	5	Mech. of Eng.	4	4
Drawing II	2 or	2	Elec. Mach.	4	4
Metal Work	2 or	2	Ht. Mach. A.	3	
Surveying	3 or	3	Mach. Design A.		4
Mats. of Const.	3 or	3	Tech. Writing		2
	15	15		16	14
Fourth Year.			*Fifth Year.*		
Adv. D. C. Mach.	3		Elec. Mach. Design	3	
Adv. A. C.	3		Gen. and Dist.		3
Adv. A. C. Mach.		6	Telephony		2
Heat Mach. B.	4		Elec. Measurements.	4	
Hydraulics		3	Business Law		3
Graph. Statics		2	Thesis	2	2
Elective	5	4	Elective	6	5
	15	15		15	15

Note: Upon recommendation of the graduate adviser in the department and approval of the dean, a research option, with maximum of 8 credit hours per semester, may be substituted, in special cases, for its equivalence in hours in the above curriculum.

Unless in this time he develops abilities that clearly qualify him for further training as an expert, his educational career may well come to a close. More than four years spent within college walls is not to be recommended except for those clearly endowed with unusual intellectual powers.

Mechanical Engineering.

Second Year.			*Third Year.*		
Subject.	Term.		Subject.	Term.	
	First.	Second.		First.	Second.
Calculus	5	5	Mech. of Eng.	4	4
Gen. Physics	5	5	Elec. Mach.	4	4
Matls. of Const.	3 or	3	Ht. Mach. A.		3
Elem. Surveying	3 or	3	Machine Work		2
Drawing II	2 or	2	Gen. Economics	5	
Metalwork	2 or	2	Pattern Making	2	
			Graphic Statics		2
	15	15		15	15
Fourth Year.			*Fifth Year.*		
Tech. Writing		2	Elem. Accounting	3	
Mach. Design A.	4		Business Law		3
Machine Design A.		3	Management Eng.	3	
Hydraulics	3		Prime Mover Design	3	3
Ht. Mach. B.	4	3	Applied Thermo.		3
Mech. Laboratory	2	2	Elective	6	6
Elective	2	5			
	15	15		15	15

Thus the arrangement, as well as the content, of a curriculum becomes of importance not only on account of the relation of the subjects to each other but in their careful gradation from the general to the specific and the particular. The Missouri curricula offer to the student in the first two years a general introduction to the field of learning. He is given an insight into American problems of citizenship through a series of lectures three times a week during the year. His training

in composition and rhetoric is by means of themes written on the subject matter suggested by the above lectures. Courses in mathematics, chemistry and physics are included in this period. Shop work, engineering drawing and elementary surveying also appear in the schedule. A student, therefore, during this two-year period should develop some interest in and taste for things common to all thinking men everywhere. He might then leave school and enter upon work allied to engineering, "the business by which he lives," with a fair probability of success in positions that do not require a high degree of expertness. Should he continue in his college work and complete satisfactorily a four-year course as laid down, he will have acquired mental discipline through his study of, and specific knowledge in, those sciences which form the basis of engineering. He will also have a share in that more fundamental training and knowledge which enables educated men to claim a common bond of interest, namely, in the field of languages, mathematics, economics and sociology; and in addition he will have been afforded a glimpse into the applications of the sciences to the art of engineering. He can not, however, claim to be expertly trained. But the successful completion of such a curriculum is surely worthy of a bachelor's degree as representing four years' work of college grade. The fifth year is planned with a view to include an amount of special training which may qualify the student as in some degree expert in some field.

It is, of course, true that much is omitted from these curricula that might profitably be included if time would allow; but educational effort should first be concentrated in those fields of thought and learning which are the common heritage of educated men; with increasing maturity of mind and development of intellectual powers the emphasis may be shifted to narrower channels, and finally in the fifth and last year of the course the student becomes largely absorbed in a narrow specialty. The arrangement of the subject matter throughout is designed to insure to the student a progressively expanding

intellectual horizon, while at the same time furnishing him a limited scope of definite and accurate knowledge. It lies finally with the *teacher* to inspire in him that love for learning and desire for intellectual growth without which curricula of any length and content are of no avail to guarantee an education.

The State University of Iowa Plan.

Dean W. G. Raymond.

Dean Raymond explained the curriculum of the School of Engineering of the University of Iowa and gave a table showing the amount of work done in each of the courses.

In the Iowa plan the courses of study in engineering are designed to insure thorough grounding in the fundamental principles underlying all engineering practice, and also to enable the student to specialize so far as is deemed wise in an undergraduate course in civil, sanitary, mechanical, electrical or chemical engineering. Work in the engineering courses is prescribed, and one complete course extending through four years must be covered in order to secure the bachelor's degree in engineering. The course in chemical engineering extends through five years, the fifth year being taken in the graduate college. There is a general engineering course of four years leading to the degree of Bachelor of Science. The courses in civil, electrical, mechanical and chemical engineering have the same course of study for the first three years and in the senior only is there a differentiation. Military drill is required three times a week throughout two years, and physical training is required twice a week throughout two years. The course in chemical engineering is different from the other engineering courses and, as stated above, extends over a five-year period.

Discussion.

W. E. Wickenden: What proportion of your students remain for five years?

Dean McCaustland: Very small proportion. About 12 per cent.

Question: At Iowa does the laboratory hour count one third?

Dean Raymond: Yes. The degree of B.S. given at end of four years. Professional degree at end of five, either M.S. or professional degree.

C. H. Crouch: Do you give B.S. in Engineering or in M.E.?

Dean Raymond: B.S.

The Stevens Plan.

President Alex C. Humphreys.

Dean Arthur M. Greene, Jr., of Princeton University, presented a letter from President Humphreys of Stevens Institute of Technology as representing the method used by a technical school in solving the problem of the curriculum at that institution.

The Course at Stevens.

As a result of our correspondence, you requested me to give you a written statement as to our single course in engineering. Let me say at once that I am not attempting to argue for the Stevens single engineering course as opposed to the scheme of several courses as followed by other schools of engineering. I do believe, however, that such a single course may have its advantages, and I certainly believe there is room in the United States for at least one such school of engineering. I do not need to remind you that Rensselaer for many years operated most successfully through a single course—civil engineering.

When I assumed the Presidency of Stevens in 1902, Stevens was carrying a single course and that in Mechanical Engineering. Even if I had wanted to branch out into other departments our endowment was not adequate. And so my problem seemed to be to develop and perfect our one course as far as possible while caring for the increasing number of students, involving additional cost to the Institute for each student admitted.

The policy at Stevens had been from the start to weave together to the possible limit, theory and practice and to make the course broad both as to technical and non-technical studies.

I was almost at once besieged to institute other courses of engineering. I was even urged to institute distinctly special courses in branches of engineering such, for instance, as gas engineering. It seemed to my associates in the gas business that I would at once accept this suggestion and they were surprised at my failure to accept their suggestion.

The effect on me was exactly the opposite from that expected by those suggesting this extension of our activities. I felt that here at least I was competent to pass an opinion, and my opinion was that the course at Stevens, being a broad course in engineering with emphasis rather than specialization on the mechanical branch, was an adequate *collegiate* preparation for the engineering of the gas business, which, by the way, is varied and broad in character.

To this view I was helped by my then opinion that engineering could not be taught in the college alone, but must be supplemented by the postgraduate work in the great school of practice and experience. Let me say here, that my opinion as to the absolute need for real study and work in the school of practice and experience has become stronger and stronger as the years of my presidency at Stevens have passed.

You ask for a short statement. It is difficult, yes impossible, to cover this great subject in a short statement—but let me here offer one of many illustrations. Mathematics, of course, is a subject that can not be ignored or even slighted by the engineer, but the student or teacher who thinks that because a student is particularly apt in mathematics he is necessarily cut out for engineering is in error. There are many features of successful engineering practice which are beyond the realm of mathematics and call for capacity to view a problem in its entirety and then to exercise sound judgment, perhaps we might say "common sense." I sometimes think we might label this great quality "*un*common sense." I

might go farther and say that the man who is essentially a mathematician is handicapped for engineering unless he is big enough to see that his mathematics is only one part (though an important part) of the engineer's equipment. Let me now say that while our one course is labeled "Mechanical," the fact is that we have always included some civil engineering and gradually, as the science of electrical engineering has developed, we have strengthened that feature of our course.

Naturally we have recognized that all branches of engineering are built upon the same foundation of physics, chemistry, mathematics, and the *so-called* cultural studies; languages and English particularly need to be included as much in one branch of engineering study as another.

All through the technical subjects as studied there is the overlap into the several branches. For instance, our strong department of Machine Design, including the two divisions of Mechanical Drawing and Mechanism, furnish the necessary fundamental instruction in draughtsmanship for any branch of engineering. Our Department of Structural Engineering, which is more in line with Civil Engineering than Mechanical, builds on this Mechanical Drawing instruction as to this feature of the department's work.

The tendency, of course, has been to overcrowd the course, and here I have been obliged to keep constantly on the alert. It is natural that the heads of our several departments should be tempted to over-emphasize their instruction and attempt to cover more ground than was possible in the four years. In some measure this was under control as long as the several departments recognized where their subjects overlapped.

As Electrical Engineering developed, for instance, illustrations and problems could be employed from other departments. Here the *effort* has always been to coördinate the several engineering departments so as to avoid as far as possible the overcrowding of the curriculum—a difficult problem, I confess.

I can not attempt to give you a full "statement of the curriculum," but I will give you the several departments as arranged alphabetically in our catalogue: Chemistry, Economics of Engineering, Electrical Engineering, Engineering Practice, English and History, Machine Design (including the division of Mechanical Drawing and Mechanism), Mathematics, Mechanical Engineering, Mechanics, Modern Languages, Physical Education, Physics, Shop Practice and Structural Engineering.

Let me refer to Economics of Engineering. Under a less pretentious title this department was organized at my suggestion about five years before I succeeded my great predecessor, Dr. Morton. When I took up the Presidency I found it expedient to take up the direction of this work, and this I have done up to the present. We cover accountancy, depreciation, estimates, contracts, patent law, banking, etc. Particularly I stress estimates and appraisals to show that all items of cost must be included and not alone engineering items.

I am firmly of the opinion that we do a real service to the young men who come to us by bringing them into real contact with the business side of engineering. I show them that for their own protection they must be qualified to analyze a statement of cost or a balance sheet. I note that of late years Washington has recognized the need for this instruction for engineers and the schools of engineering generally are taking up this line of instruction in one way or another. With us, we take it up seriously at the beginning of the second term junior year and carry it on through both terms senior.

I may also say that in our Physical Education Department we hold the students of all four classes to as strict an observance of the schedule of hours in that department as in any other department. The head of the department is a full member of the Faculty and he lectures to the students on hygiene and has *full control of athletics,* and it is his duty to

see to it that athletics and the studies of the curriculum *are kept in* balance. To this feature of our work I am constantly alert. The students are all examined carefully as to their physical condition when they enter and they are assigned to exercises fitted to their physical make-up.

As to other student activities, the head of our Department of Mathematics is Dean of Student Activities and he has authority and responsibility as to the maintenance of the balance in general between these activities and the curriculum requirements. Early in my presidency I selected certain heads of departments for the offices of Class Deans—Freshman, Sophomore, Junior and Senior.

These five deans, with the Secretary of the Faculty, the Registrar and the President, compose the Scholarship and Discipline Committee which meets regularly once a week and takes up all those questions which are constantly coming up for consideration and settlement. The Faculty meets less often.

In closing this incomplete and hastily prepared statement let me say that not infrequently I have been obliged to differ with educators (not of schools of engineering alone) on the question suggested by what I have said as to the importance of the postgraduate work in the field of practice and experience. As a practicing engineer of pretty long and wide experience, covering great responsibility as to administration, I do not hesitate to say that the worst experiences I have suffered from in my employees has been from men who failed to recognize the truth of my view and so relied upon their college training to the ignoring of practice and business requirements.

Here I think is to be found the basis of the constantly recurring demands that the college course should be lengthened. I have always opposed this, for there is the danger that the longer the student stays in college the less he will appreciate the demands for the training to be procured only in the field of practice and experience. I confess that especially of late

years—particularly since the war—the students, many of them, have been coming to us not adequately prepared. The remedy for this is through better work on the part of the public and private schools, or, if this can not be brought about, a preparatory year, supplementing *where necessary* the work of the high school. But this only for the preparation that we have a right to expect from the high school and which we do get from some of the public and private schools.

I have noticed with much interest that certain professors who were warm advocates of adding to the years of school of engineering education, after more intimate contact with practice in the fields of engineering, have completely changed their views on this all-important question.

Discussion.

Gen. Mitchell: There is a matter referred to in the Stevens plan not mentioned in the letter. They have a supplementary term for three summers, during which time they take surveying, shop work and some laboratory courses, so it is essentially a four and one half year course.

Discussion on English.

Dean Anderson: There is one item of the content of the curriculum to be noted. There seems to me to be a relatively small percentage of time given to study of English. We speak of desiring the students to get in closer touch with humanities, but it seems to me that in this conference we have not emphasized or discussed the amount of time devoted to the study of English. Our practice is to take two full years of English. Three hours a week.

Dean Hughes: Perhaps it would not be better instruction to require a certain greater amount of time for prescribed work.

Dean Kenerson: That is done in our institution. The number of hours prescribed for this or that subject cannot be

known until one knows what time is given by the student to it. To some of us who are in the habit of looking over catalogs it looks like supplementary courses. It makes very little difference how many hours we schedule; much depends upon how we stimulate the interest of our students. Succeed in interesting the students that they put in fair proportion of their time on those studies and they get just as much out of their courses as if program had scheduled more. We schedule English through two years, three hours per year, but that does not constitute the amount of instruction given in English. If at the end of the senior year the men have not demonstrated the use of English they are held up, and in one or two cases we have withheld degrees from men and sent them back to the Department of English for further instruction.

Dean Raymond: I am not sure that the tabulations I gave carried the correct amount of English. We have three hours the first year and in addition we have two periods a week on speech. During two summer vacations we require certain lines of reading and reports when they return, and in addition to that we have two hours of English throughout the senior year.

J. R. Nelson: The English Committee is very anxious to receive this information so that when Mr. Wickenden calls on us for services in engineering schools we shall have our work ready.

C. R. Richards: I tried an experiment at the University of Illinois. About ten years ago, after a great deal of discussion about the illiteracy of the engineer, we agreed that if it became evident to the faculty that the student in the college of engineering was unable to read or write he might be brought before the faculty and required to take English for graduation. I remember, as chairman of this committee, a student sent to me a petition and in that there were 12 misspelled words. I turned this over to myself as chairman of the English Committee. This plan has not worked because of the indifference of the members of the faculty to report to the com-

mittee cases of illiteracy on the part of the students who turn in papers. Otherwise it would get some reasonably good results.

Dean Hughes: We require only six hours in Freshman year, but in order to satisfy that requirement a student must have very satisfactory passing marks. If he fails he must take it all over. If he passes unsatisfactorily he must take additional courses. A committee supervises English for engineering college and business administration and these men have to report to the chairman of the committee and take work he lays down for them.

Professor Lewis: The main issue that has been raised here is whether courses should be lengthened and if it is to be professional preparation or cultural. As to this relation of English to the subject it is closer related to the whole. As I have listened I have thought of what instruction they are getting. How was it possible for men like Faraday, Edison and others to accomplish what they have done without all these accomplishments? It seems to me that in matters of expression you have different types and they have to be considered. Edison never was a leader. Steinmetz was. Engineers express themselves. It is hard to get any instructor to combine all those virtues and produce them in him. Some time you can get it and most all by the grace of God if you do get it. You have to make use of English and it is not going to be possible for any teacher of English to give us the power of expression when he himself does not have it. Public speaking! One of our men said to me that the most important thing he got in college was training in public speaking. It helped him in right lines; it requires the same power of analysis that I find in the task of dictating. That is important, but could not the same thing be obtained in engineering subjects, studies that require to come before the class and explain? Could not that be done without recourse to English departments? It is rather difficult to ask juniors to come forward and talk on engineering subjects. If he were required

to come before a class, I think he would acquire all the necessary practices in public speaking. What is English? I never took a course in college. To this day I am not quite sure what the subject is—what must be covered. Power of expression? Why? Is it not more important for the engineer to analyze his subject and state it with clarity than state it with grace? I never saw a paper yet that I thought I could not improve. A letter is the man. A letter has force. It carries with it a life of the whole man. What he says he means and he gets across. He succeeds in stating each of these questions with the economy of an engineer. I could not possibly have written that, so I think that teachers of English have to consider each individual. He has to use good common sense if he can get it.

At Lewis Institute we require 60 clock hours of class work in writing. The second 30 hours of that are devoted to technical expression. One fellow—a Lithuanian—could not get our grammar. I think the man is a born engineer. I would pass him without English. It is not worth while in his case. It is different in other cases. As to the matter of literature, Professor Nelson has stated that we do not touch literature. I assure you that Professor Nelson is very literary and that he is increasing the students' vocabulary all the time. It is not as a machine and I believe he finds a thirst for literature as the expression of the man and not the engineer. Years ago I had Freshmen for a whole year. I gave them one fourth first of expression, one fourth of business law. The point in that was that I might learn something about it myself. It seems to me that the engineering effect on the college of arts is good. Every man to-day knows something about machinery. We appreciate very little of it and forget what we should remember. A student said to me one day: "When I took this work I thought I was going to get something different from your department and I find there is no difference. I hoped that before I graduated I was going to

get some poetry." We took a vote. As a man the entire class revolted and we spent the rest of the quarter on Shakespeare and had a good time.

The subject of the teachers of English as members of the engineering faculty received attention at this conference and was discussed at length.

(*Continued.*)

SECTIONS AND BRANCHES.

Fall Meeting of the Kansas–Nebraska Section held at the University of Kansas, October 24–25, 1924.—Preceding the opening of the formal session in the evening the visiting delegates were entertained at a steak fry on the campus. Fortunately, nearly the entire delegations were present on this occasion, which was thus made most enjoyable.

Evening Session.

At 8 o'clock the first formal session was called to order by President R. A. Seaton. After reading and approval of the minutes of the previous meeting held at the University of Nebraska October 19–20, 1923, announcements were made by the secretary in regard to registration, lodging and football tickets.

President Seaton then introduced Professor F. M. Dawson as the speaker to open the first topic for the evening. This topic was "In conducting laboratory work should the instructor give the students careful guidance and assistance throughout the work, or should the work be laid out clearly and the students left to the proper solution without further assistance?" Mr. Kerchner of Kansas State Agricultural College, Professors Tait of Kansas, and Edison of Nebraska followed Professor Dawson with prepared papers upon this topic, after which a general discussion was enjoyed.

The second topic for the evening meeting was "Is it advisable for an engineering college to employ or otherwise engage a limited number of practicing engineers and executives to offer supplementary instruction in the regular senior engineering classes?" Professor Hood of Kansas, who was to have been the first speaker on this topic, was unable to be present. Professor Conrad of Kansas State Agricultural College, Professor Russell of Kansas, and Dean Ferguson of Ne-

braska presented their views in prepared papers, after which a general discussion was again indulged in.

Before adjourning at the close of this discussion President Seaton appointed (with objection) Professor Chatburn of Nebraska, Chairman, with Shaad of Kansas, H. B. Walker of Kansas State Agricultural College as Committee on Nominations. There were 59 present at this meeting.

Morning Session.

The meeting was called to order at 9 o'clock with President Seaton in the chair. The topic for discussion was "Should we have a non-degree two or three year course for engineering students who after entering college find themselves unable to carry mathematical subjects and hence, under our present system, are forced to drop out of college during the first year?" The appointed speakers for the morning were Professor Haney of Nebraska, Dean Walker of Kansas, Shaad of Kansas, Chatburn of Nebraska, and H. B. Walker of K. S. A. C. In the general discussion that followed President Bainter of Kansas City Junior College contributed some interesting remarks. President Seaton introduced Mr. Wickenden, Director of Investigations for the Society, who spoke at some length on the tendencies in professional education.

At the close of Mr. Wickenden's address Professor Chatburn, Chairman of the Committee on Nominations reported the proposed slate for the next year as follows: For President, Dean O. J. Ferguson of Nebraska; for Secretary, G. W. Bradshaw of Kansas; and Chairman of the Program Committee, A. J. Mack of K. S. A. C. Upon motion by Young of Kansas the secretary was instructed to cast the unanimous ballot of the section for the candidates as nominated.

A motion by Chatburn of Nebraska, seconded by Brackett of Nebraska was carried unanimously voting thanks to the local members for their care in providing accommodations and entertainment. A motion by Sluss of Kansas was likewise unanimously carried that the sympathy of the section be

extended to Professor Evinger of Nebraska on account of the serious illness of Mrs. Evinger. Upon the motion of Chatburn of Nebraska seconded by McNown of Kansas it was voted to accept the invitation to hold the meeting next year at Manhattan. Meeting adjourned. There were 60 present at this session.

Following the formal adjournment of the Kansas-Nebraska Section a luncheon was served at the Country Club in honor of the visiting delegations.

The Minnesota Section held its first meeting of the year in in Room 201 of the Minnesota Union October 27, 1924. Forty-seven members and guests gathered for 5:45 o'clock dinner.

Professor F. H. Bass, President of the Section, presided.

After a short introductory speech by President Bass, the speech of the evening was given by Professor W. H. Kirchner, who told of his recent travels in Europe and gave many interesting observations in connection with Engineering Education over there.

Professor Brooke spoke on the work of the Engineering Education Research Committee. In this connection there was a lively discussion in the question as to whether the entering freshmen are as well prepared now as they were ten years ago. The majority seemed to be of the opinion that the incoming freshmen are at least as capable and well prepared as they ever have been.

The meeting adjourned at 8:00 P.M.

R. W. FRENCH,
Secretary.

The Minnesota Section held its second meeting of the year in Room 201 of the Minnesota Union on December 16, 1924. Sixty-five members and guests gathered for 5:45 o'clock dinner.

Professor F. H. Bass, President of the Section, presided.

President L. D. Coffman addressed the meeting, taking for

his subject the freshman problem. It was apparent from the address that the administration has given and is giving a great deal of serious thought to this problem and that the near future may see some considerable changes in our methods of handling freshmen. In this connection the President made it clear that he is strongly in favor of an *all freshman year* for the entire University and that the administration of this year should not be in the hands of the several departments but should be handled by its own administrative machinery.

The President's address was followed by a lively discussion, in which Dean Leland and Professors Shepardson, Comstock, Forsythe, and Miller joined, on the practical problems involved in an attempt to adjust the professional schools to a change of this kind.

The meeting adjourned at 9:15 P.M.

R. W. FRENCH,
Secretary.

North Carolina Section.—On September 27 of last year, thirty-one members of the faculties of the North Carolina State College of Agriculture and Engineering, the University of North Carolina, and Trinity College, met in the Faculty Club of Trinity College, Durham, N. C., to organize the North Carolina Section of the Society. With Ex-President Riddick of the State College presiding, the following officers were elected: Chairman, Wm. Hand Browne, Jr., head of the Department of Electrical Engineering at the State College; Vice-Chairman, G. M. Braune, Dean of the Engineering School at the University; Secretary, D. C. Jackson, Jr., in charge of Electrical Engineering at Trinity College; Treasurer, W. H. Hall, head of the Department of Engineering at Trinity College.

The second meeting took place at the State College in Raleigh on November 17. Mr. Frank Page, the State Highway Commissioner, spoke on "The function of Engineering Schools in Training Students for Service to the State." Among other things he pointed out the advantage to the State

as an employer and to the young engineer himself, just out of college, of having had the practical experience gained in a co-operative course. He also urged a closer coöperation and more frequent exchange of ideas between the teaching and practising engineer.

At this meeting the notice of the Council's authorization of the North Carolina Section of the Society for the Promotion of Engineering Education was read and the announcement was made of the gift from the Carnegie Corporation to the Society of $108,000 for the study of engineering education.

The committees of the Section were announced also, probably the most important one being the Investigation Committee to coöperate with the Board of Investigation and Coordination. This committee was composed of Dean Braune, Chairman, Dr. Howell, Secretary, both of the University, Professors Shaw and Vaughan of the State College, and Professors Edwards and Jackson of Trinity College.

On December 15, the Section met at the University in Chapel Hill for its third meeting. Dean Braune gave a talk on "Coöperative Engineering," after which occurred probably the most animated discussion of any of the five meetings of the year. The benefits of the coöperative type of engineering course were brought out clearly in the discussion, as well as the points of view of the coördinator with some years of experience in the work, of a man new in the field of coördination, and also of the student.

For the fourth meeting the Section returned to the State College, where Mr. Paul A. Tillery, Vice-President and General Manager of the Carolina Power and Light Company, spoke on "The Education of the Engineer," and Professor H. B. Shaw, Director of the Engineering Experiment Station at the State College, gave a talk on "Engineering Education."

The final meeting of the year was held in conjunction with the annual meeting of the North Carolina Academy of Sciences on the morning of May 3 at Trinity College. At nine o'clock, Mr. W. E. Wickenden addressed the assembled Academy on "Present-day Problems in Engineering Education," and as

is always the case wherever he is, he was quite the ablest and most agreeable speaker of the session. The S. P. E. E. Section then adjourned to the Trinity College Faculty Club, where Dr. T. P. Harrison, head of the Department of English at the State College, presented a paper on "The Teaching of English for Engineers." A discussion of the work of the Section's Investigation Committee was then entered upon, which was led by Mr. Wickenden.

The result of the election of officers for 1924–'25 was as follows: Chairman, W. H. Hall, of Trinity College; Vice-Chairman, John M. Foster of the State College; Secretary, D. C. Jackson, Jr., of Trinity College; Treasurer, G. M. Braune of the University.

During the year the Section's Membership Committee, consisting of W. H. Hall, Trinity College, Chairman, John M. Foster, State College, and Thorndike Saville, University, more than doubled the membership at the three institutions, increasing it from 17 to 44. Professor Foster seems to have been the most convincing of the committee, since there were only 5 member at State College in September, but at the time of the meeting in May the State College members numbered 25.

The North Carolina Section, having passed one year successfully, is now planning for an even better second year. The first meeting was held on December 6 at the State College in Raleigh. It was given over to a discussion of the Boulder convention by Dr. Riddick and Dr. Harrison of the State College. They both agreed that the high point of the convention was the report of Mr. W. E. Wickenden, Dr. Riddick stating that it was "the meat of the Convention," and discussing it in some detail. Dr. Harrison among other things spoke of the cordiality and again of the pleasant hospitality of the Boulder members of the Society.

The Membership Committee of the Section this year hopes to outdo the record of last year's committee, and will make strenuous efforts to double the number of members in North Carolina. The Program Committee has arranged an inter-

esting program for the entire year which will provide papers on a series of related subjects.

D. C. JACKSON, JR.,
Secretary.

Purdue Branch.—The Purdue Branch of the Society for the Promotion of Engineering Education held its first meeting of the school year Thursday evening, December 11, in the Purdue Memorial Union Building.

Professor Chambers, Chairman of the Branch, presided and introduced the speakers of the evening—Professor A. P. Poorman, who read a report of the Boulder meeting, Dean A. A. Potter, who gave a comprehensive view of the work and problems confronting the S. P. E. E., and Professor R. B. Wiley, who presented a paper dealing with the coöperative work of the S. P. E. E. now being carried on at Purdue University.

Professor Poorman who reported on the 32d meeting of the Society at Boulder, Colorado, said statistics showed that the past year was one of the most prosperous in the history of the Society. He briefly reviewed some of the subjects which were discussed at this meeting and gave as the idea of President Walker that the aim of the engineering college was to deliver service rather than to produce leaders for the profession. The meeting at Boulder was well attended, 161 members and 207 guests being present.

In his paper, Dean Potter presented a series of important questions, which concern engineering teaching. Some of the most important are as follows:

First: What are the functions of Engineering Education?

Second: Do our engineering colleges attract the most desirable students?

Third: Do our curricula tend to produce maximum mental growth?

Fourth: Would it be desirable to make our courses more flexible?

Fifth: Should the colleges assume any responsibility for the training of students?

Sixth: Are the engineering curricula successfully adjusted between industry and teaching?

Seventh: Is the teaching such that engineering teaching is improving?

Eight: Are we training too many or not enough students?

The above questions were discussed and their bearing or engineering education shown fully by the speaker.

A very interesting and instructive paper was next read by Professor Wiley of the Civil Engineering Department. Professor Wiley illustrated his talk with graphical charts and brought out a great many interesting facts in connection with the investigation now being carried on at Purdue. The average age of the entering freshmen is 18 years and 10 months. To attend college they traveled an average distance of 95 miles.

The paper further discussed the reasons for choosing engineering as a life work, the employment of time before entering and the quality of preparation with which the student entered college.

Professor Wiley explained that the work of investigation at Purdue was divided into four main divisions, the first two of which only were completed:

First: A study of the entering students.

Second: Admissions and eliminations.

Third: Graduates and former students.

Fourth: Teaching personnel.

Dr. Hatt who had been scheduled to speak on the subject of "Good Teaching" said that the former speakers had made things so clear that he could hardly add anything new.

The meeting adjourned at 9:00 P.M. with an attendance of 40 including members and guests.

JOHN A. NEEDY,
Secretary.